Master Thesis in Geosciences

Provenance of the Asker Group, Oslo Rift

A detrital zircon U-Pb and Lu-Hf study

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Abstract

To identify possible protosources for the Asker Group 573 in situ LA-MC-ICPMS uranium-lead and 509 lutetium-hafnium analyses were performed on detrital zircon grains from seven samples. The samples from the Kolsås and Skaugum Formations did not yield enough zircons (2 and 5, respectively) to be statistically viable, while for each of the five other samples, where three belong to the Tanum formation and two were taken from an area where no formational subdivision has been done, ~ 100 zircon grains were analyzed.

Major peaks and age clusters in the recorded 313 ± 4 to 2844 ± 14 Ma age span coincides with virtually every significant period of magmatism in Fennoscandia – including Archean, Svecofennian, TIB, Gothian, Sveconorwegian and Caledonian magmatism. This is also confirmed by the initial $^{176}Hf/^{177}Hf$ ratios. One major peak at c. 350 Ma does not correspond with any known magmatism in Fennoscandia, and is thus likely from the Variscides of Central Europe or the British Isles.

Comparison of the recorded data with U-Pb and Lu-Hf data from the Ringerike Group and the Orsa sandstone suggests that the bulk zircon detritus of the Asker Group were derived from recycled Silurian sandstone cover sequences outside the Oslo Rift area, with a significant contribution from the Variscan mountains.

Acknowledgements

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Lastly, for what is arguably too many years of free room and board, I would like to thank my parents.

Contents

1 Introduction

1.1 Purpose of Study

The Asker Group (Dons and Gyröy, 1967) – a thin sedimentary sequence consisting of mostly shale, conglomerate, sandstone and minor limestone (Henningsmoen, 1978) – is located in the Permo-Carboniferous Oslo Rift which is situated in southwestern Fennoscandia. The sedimentary rocks making up the Asker Group were deposited as a thin carpet of sediments during the proto-rift and initial rift phases of the development of the Oslo Rift (Larsen et al., 2008), and are divided into three formations separated by two major unconformities (Dons and Gyröy, 1967; Larsen et al., 2008).

Uranium-lead (U-Pb) dating of detrital zircons from the Asker Group as well as the underlying Silurian Ringerike Group (Davies et al., 2005) were done by Dahlgren and Corfu (2001). They concluded that it is unlikely that the bulk detritus of the Asker Group is derived by recycling of the Ringerike Group, and suggested that the rivers feeding the Asker Group originated in the Variscan mountains and mixed with sediments of typical southwestern Fennoscandian signature somewhere north of the Thorn suture. Because of the low number of zircons analyzed (1-19) a reexamination of the age distribution of detrital zircon and additional lutetium-hafnium (Lu-Hf) analyses is needed to get a more robust picture of the protosources of the Asker Group and to test the validity of the conclusions of Dahlgren and Corfu (2001).

The aim of this study is to:

a) characterize the U-Pb age and Lu-Hf isotope composition on a statistically significant number of detrital zircons from the Asker Group by in-situ laser-ablation microprobe multi-collector inductively coupled plasma mass spectrometry (LAM-MC-ICPMS) analyses

b) identify possible protosources for the Asker Group

1.2 Study area

The study area is located in the central part of the Oslo Rift, and extends from Semsvannet in Asker to Dronningveien in Hole. Since the Asker Group is often covered by debris from overlying rocks or vegetation, good field localities are sparse. The localities used in this study range in setting from forest to more suburban areas.

2 Regional Geology

2.1 Introduction

The basement rocks bordering the Oslo Rift are part of the Southwest Scandinavian Domain (SSD), which, along with the Archean Domain in the northeast, and the Svecofennian Domain and the Transscandinavian Igneous Belt (TIB) in the central part, make up the Precambrian crust of the Fennoscandian Shield (Fig. 1) (Gaál and Gorbatschev, 1987). After their formation these domains were reworked to varying degrees. A general younging from the northeast to the southwest is observed (Gaál and Gorbatschev, 1987).

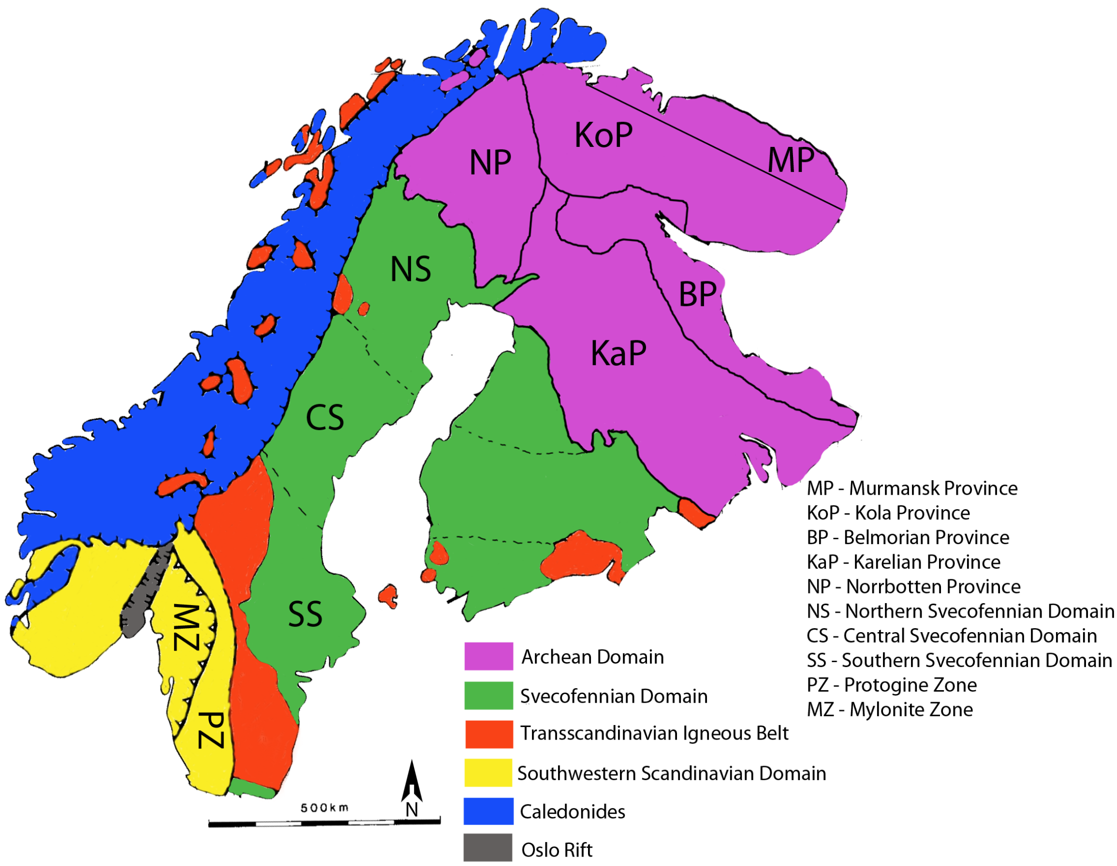

Figure 1: Rough subdivision of the Fennoscandian Shield, modified after Gaál and Gorbatschev (1987) and Hölttä et al. (2008).

2.2 The Archean Domain

Archean continental crust comprises much of the eastern and northern parts of the Fennoscandian Shield (Fig. 1), where it is divided into five crustal provinces (Hölttä et al., 2008). From southwest to northeast these are the Karelian, Belomorian, Kola and Murmansk Provinces, respectively (Slabunov et al., 2006), as well as the poorly studied Norrbotten Province (Hölttä et al., 2008). About 80% of the area is made up by tonalitic-trondhjemitic-granodioritic (TTG) associations, with subordinate greenstone belts, paragneisses, granulite complexes and migmatitic amphibolites (Slabunov et al., 2006; Hölttä et al., 2008). Neoarchean (2.8-2.5 Ga) rocks are most common, but locally Mesoarchean (3.2-2.8 Ga) or reworked Mesoarchean formations make up a significant part of the bedrock (Lauri et al., 2011).

The oldest continental crust of the Fennoscandian Shield is found in the western part of the Karelian Province (Gaál and Gorbatschev, 1987; Gorbatschev and Bogdanova, 1993; Slabunov et al., 2006), where zircon from a trondhjemite gneiss from Siurua (N Finland) was found to have a magmatic age $\sim$3.5 Ga (Mutanen and Huhma, 2003; Lauri et al., 2011). A small amount of xenocrystic zircon cores from the same sample were found to have ages around 3.7-3.6 Ga (Mutanen and Huhma, 2003; Lauri et al., 2011).

At least four major accretionary phases and one collisional event led to the formation of the 3.5-2.64 Ga Archean Domain (Slabunov et al., 2006).

2.3 The Svecofennian Domain

After the emplacement of 2.50-2.44 Ga plume-related, layered gabbro-norite intrusions and dyke swarms rifting of the Neoarchean crust of the Fennoscandian Shield became widespread (Lahtinen et al., 2011) lasting until 2.1 Ga (Daly et al., 2006). At approximately 2.1 Ga drifting initiated, separating cratonic components by newly formed oceans (Lahtinen et al., 2008).

Several models for the tectonic evolution of the Svecofennian orogeny have been proposed (e.g. Baker et al., 1988; Gaál, 1990; Lahtinen, 1994; Nironen, 1997). Recently Lahtinen et al. (2005) rejected the notion of a semi-continous Svecofennian orogeny and suggested five partly overlapping orogenies in the period

1.92-1.79 Ga: the Lapland-Savo, the Lapland-Kola, the Fennian, the Nordic and the Svecobaltic orogenies. Lahtinen et al. (2005) also suggested four major stages for the orogenic evolution, with microcontinent accretion (1.92-1.88 Ga), large-scale extension of the accreted crust (1.87-1.84 Ga), continent-continent collision (1.87-1.79 Ga) and gravitational collapse (1.79 and 1.77 Ga). This model was further developed by Korja et al. (2006).

The Northern and Central Svecofennian Provinces (Fig. 1) as defined by Gaál and Gorbatschev (1987) were mostly formed during the Lapland-Savo orogeny, while the Southern Svecofennian Province was formed in the Fennian orogeny when the Bergslagen microcontinent was accreted to the newly formed Lapland-Savo orogenic belt (Korja et al., 2006). The Northern and Southern Svecofennian Provinces are volcanic belts with predominence of calc-alkaline volcanic suites dominated by rhyolites and dacites, and were formed between 1.90-1.87 Ga (Gaál and Gorbatschev, 1987). The Central Svecofennian Province is mostly comprised of metagraywackes and metapelites (Gaál and Gorbatschev, 1987).

2.4 The Transscandinavian Igneous Belt

Three distinct generation of granitoid intrusions are found in the Svecofennian Domain: 1.90-1.86 Ga Svecofennian synorogenic, mostly I-type granites, which make up the bulk of the continental crust of the Svecofennian Domain; 1.85-1.65 Ga mostly I- and S- type granitoids; 1.65-1.50 Ga A-type rapakivi granites (Gaál and Gorbatschev, 1987; Andersen et al., 2009 and references therein). A roughly north-south trending belt of granitic intrusions and rhyolitic porphyries, extending between southeastern Sweden and the coast of north-central Norway – the Transscandinavian Igneous Belt (Fig. 1) – which separates the Svecofennian domain from the Mesoproterozoic Gothian and Sveconorwegian terranes of the Southwestern Scandinavian Domain, belongs to the 1.85-1.65 Ga group (Gaál and Gorbatschev, 1987; Andersen et al., 2002; Gorbatschev, 2004; Andersen et al., 2009). According to the Svecofennian orogenic model of Korja et al. (2006) most of TIB was formed during the Nordic orogeny, when a continent-continent collision occured between Amazonia and Fennoscandia at 1.82-1.80 Ga.

Three generations of TIB granitoids are recognized: 1.86-1.83 Ga (TIB-0), 1.81-1.76 Ga (TIB-1) and 1.71-1.67 Ga (TIB-2 and TIB-3) (Larson and Berglund, 1992; Andersson et al., 2004; Gorbatschev, 2004). TIB rocks show a general tendancy towards monzogranitoid, alkali-rich lithologies, and are commonly I- and A-type or transitional (Gorbatschev, 2004).

Nine late Paleoproterozoic (1.86-1.68 Ga) granitoid intrusions, six from TIB, one from the Oskarhamn-Jönköping Belt, and one early and one late orogenic granite from the Svecofennian Domain, were studied by Andersen et al. (2009). Zircons from these intrusions showed little variation in initial $^{176}Hf/^{177}Hf$ (0.2816-0.2818), defining a trend characterized by initial $\varepsilon_{Hf(1.88Ga)} = +2 \pm 3$ and an average $^{176}Lu/^{177}Hf = 0.015$, suggesting that the granitic melt was formed by melting of juvenile crust formed in the Svecofennian orogeny (Andersen et al., 2009).

By c. 1.6 Ga essentially all crust in the Svecofennian Domain was stable, and only minor addition of crust took place after this time (Söderlund et al., 2005).

2.5 The Southwest Scandinavian Domain

The evolution of the Southwest Scandinavian Domain has been a matter of some controversy and no consensus has yet been reached. The discussion revolves around two incompatible models – in the model of Berthelsen (1980) the SSD is viewed as a separate continental fragment which docked with Fennoscandia at some time in the mid-Proterozoic (Åhäll and Gower, 1997), while in the model of Torske (1985) the SSD has been a part of Fennoscandia since the formation of the continental protolith in the early Proterozoic (Andersen et al., 2001). Here, the non-genetic regional nomenclature of Andersen (2005b) is used.

The Southwest Scandinavian Domain is the westernmost rim of the Fennoscandian Shield (Fig. 1), separated from the rest of the shield by the Transscandinavian Igneous Belt and a major belt of shearing and faulting – the Protogine Zone. It is largely comprised of Gothian (1.75-1.50 Ga) rocks, and has been reworked to some extent during three major geological events: the Hallandian thermo-magmatic event (1.46-1.38 Ga) (e.g. Christoffel et al., 1999; Söderlund et al., 2002), the Sveconorwegian Orogeny (1.25-0.9 Ga) and the Caledonian

Orogeny (0.6-0.4) (Gaál and Gorbatschev, 1987). Post-Gothian additions to the continental crust are relatively minor (Gaál and Gorbatschev, 1987).

The Gothian crust of the SSD was formed during a 200-250 m.y. period of subduction of oceanic crust along the southwestern margin of the Fennoscandian Shield (Andersen, 2005b and references therein). Gothian rocks show a change from calcic/calcalkaline in the west to alkali-calcic and alkaline rocks in the east (Gaál and Gorbatschev, 1987 and references therein).

Anorogenic magmatism and sedimentation followed the subduction related Gothian magmatism, starting at 1.51-1.50 Ga in the Hardangervidda-Rogaland, Telemark and Bamble-Lillesand blocks (Fig. 2). Felsic and mafic intrusive activity, including the Hallandian thermo-magmatic event, is characteristic of the 1.5-1.2 Ga period further east (Andersen, 2005b, and references therein).

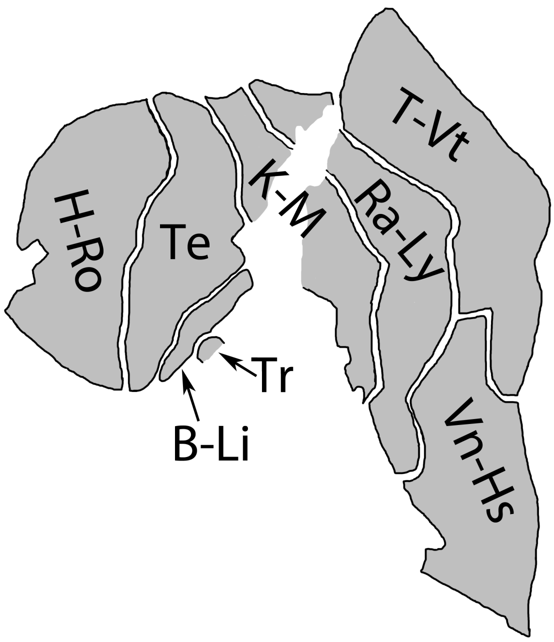

Figure 2: Sketch of the SSD (after Andersen, 2005b). H-Ro — Hardangervidda-Rogaland, Te — Telemark, B-Li — Bamble-Lillesand, Tr — Tromøy, K-M — Kongsberg-Marstrand, Ra-Ly — Randsfjord-Lygnern, Vn-Hs — Vänern-Halmstad, T-Vt — Trysil-Vättern

Sveconorwegian influence on the SSD include several events of magmatism, metamorphism, deformation and tectonic displacement (Andersen, 2005b), and decreases towards the Sveconorwegian Frontal Deformation Zone (Söderlund et al., 2002). Development of juvenile crust was relatively minor at this time (Andersen, 2005b).

2.6 The Scandinavian Caledonides

The Scandinavian Caledonides (Fig. 1) – an 1800 km long and up to 400 km wide thrust and fold belt – make up the western margin of the Scandinavian Peninsula. They are the preserved remnents of the Caledonian orogeny which occured as a result of continent-continent collision between Baltica and Laurentia (Korja et al., 2008). The formation of the orogenic belt was initiated around 540 Ma when the Iapetus Ocean that lay between Baltica and Laurentia started to contract. Around 425-400 Ma the continents collided, pressing Baltica beneath Laurentia, thrusting sedimentary and volcanic rocks originally deposited on the margin of Baltica, the floor of the Iapetus ocean and likely on the Laurentian margin, onto Baltica from the west/northwest (Gee et al., 2008; Korja et al., 2008 and references therein).

The thrust sheets are traditionally grouped into the Lower, Middle, Upper and Uppermost allochthons (Roberts and Gee, 1985), which all rest on the autochthonous crystalline basement with its late Neoproterozoic to Silurian metasedimentary cover (Gee et al., 2008). The Lower and Middle allochthons represents the pre-collisional continental margin of Baltica; the Upper allochthons consists mostly of Iapetus-derived sedimentary and igneous rocks such as island arc and back arc basin assemblages and ophiolites; rocks of Laurentian affinity can be found in the Upper and Uppermost allochthons (Gee et al., 2008).

Basement windows reveal that the Precambrian basement gradually become more reworked to the west (Gee et al., 2008).

2.7 The Oslo Rift and the Asker Group

In the Permo-Carboniferous the two continents Laurussia and Gondwana collided – an event termed the Variscan Orogeny – resulting in the final formation and internal suturing of the supercontinent Pangea (Olaussen et al., 1994; McCann et al., 2006). As a result several wrench fault systems developed in Northern Europe (McCann et al., 2006; Ziegler et al., 2006), which in turn caused widespread rifting of the crust, producing several rift structures both inside the orogen and the foreland (McCann et al., 2006 and references therein). The largest and northernmost of these rift structures is the Oslo Rift which developed as a result of rifting north of the NW-SE trending Sorgenfrei-Tornquist Zone (Fig. 3) (Larsen et al., 2008) caused by extensional stress fields linked to the late stages of the Variscan Orogeny and strike-slip faulting (Heeremans et al., 1996).

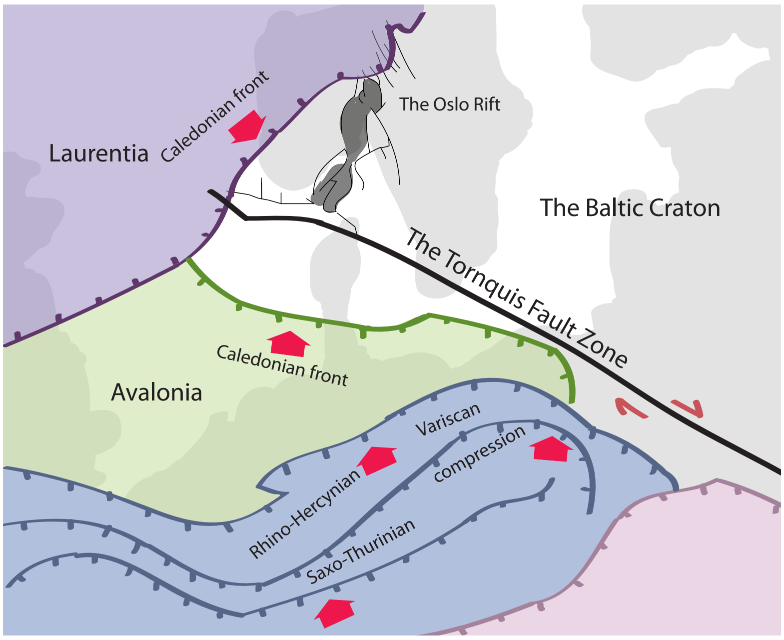

Figure 3: Simplified tectonic overview of Western Europe with the Variscan front, the Tornquist fault system and the Oslo Rift (after Larsen et al., 2008). Pre-rift configurations with the Caledonian structures are also shown.

The Permo-Carboniferous (310-245 Ma; Ramberg and Larsen, 1978; Olaussen et al., 1994) Oslo (paleo)-rift (Fig. 1, 3 and 4) is an en-echelon array of smaller graben segments (Larsen et al., 2008), which from the south are: the offshore Skagerrak Graben (Ro et al., 1990a) and the onshore Oslo Graben which is further subdivided into the Vestfold, Akershus (Ro et al., 1990b) and Rendalen Grabens (Larsen et al. 2006, 2008). It extends northwards from the Sorgenfrei-Tornquist Zone and dies out northeast of Mjøsa (Larsen et al. 2006, 2008).

The Skagerrak Graben is comprised of NE-SW-striking half grabens (Heeremans et al., 2004, and references therein). The accomodation zones of the three graben segments (Fig. 4) which make up the Oslo Graben is the Kjaglidalen-Krokkleiva Transfer Fault (Heeremans et al., 1996) and the Solberg Horst, between the Vestfold and Akershus Grabens, and the Akershus and Rendalen Grabens, respectively (Larsen et al., 2008). The Vestfold Graben has a W-verging master fault to the south – the Oslofjord Fault, the Akershus Graben has an E-verging master fault to the west – the Ransfjord-Hunnselv Fault, and the Rendalen Graben has a W-verging master fault – the Rendalen Fault (Larsen et al., 2008).

The development of the Oslo Rift has been divided into five/six stages by several authors (e.g. Ramberg and Larsen, 1978; Neumann et al., 1992; Larsen et al., 2008). Here, nomenclature of Larsen et al. (2008) will be used, whose stages can be described as follows (approximate age ranges taken from Heeremans et al., 1996): (1) the proto-rift forerunner to rifting (315-295 Ma), (2) the initial rift and first basaltic volcanism (295-290 Ma), (3) the rift climax, with rhomb porphyry fissure volcanoes (290-275 Ma), (4) the mature rift, with central volcanoes and caldera collapse (275-265 Ma), (5) the magmatic aftermath, with major syenitic batholiths (265-255 Ma), (6) rift termination, with the youngest small granite intrusions (255-245 Ma).

The Asker Group which was deposited during the first two stages of the rift development (Larsen et al., 2008), is found throughout much of the Oslo Graben, but is locally very thin or missing (Henningsmoen, 1978). The proto-rift sediments are found as far northeast as Nittedal (Naterstad, 1978). The Asker Group has in the central Oslo Graben (Asker-Bærum area) been subdivided into three formations (Dons and Gyröy, 1967), from below these are: the Kolsås Formation and Tanum Formation which belong to the proto-rift stage, and the Skaugum Formation which belong to the initial rift stage (Larsen et al., 2008).

2.7.1 The Kolsås Formation

The Kolsås Formation (Fig. 5) unconformably overlies folded Cambro-Silurian sediments, and consists of 20 m of red mudstones, very fine grained sandstones, and less commonly grey to green coarser grained sandstones, conglom-

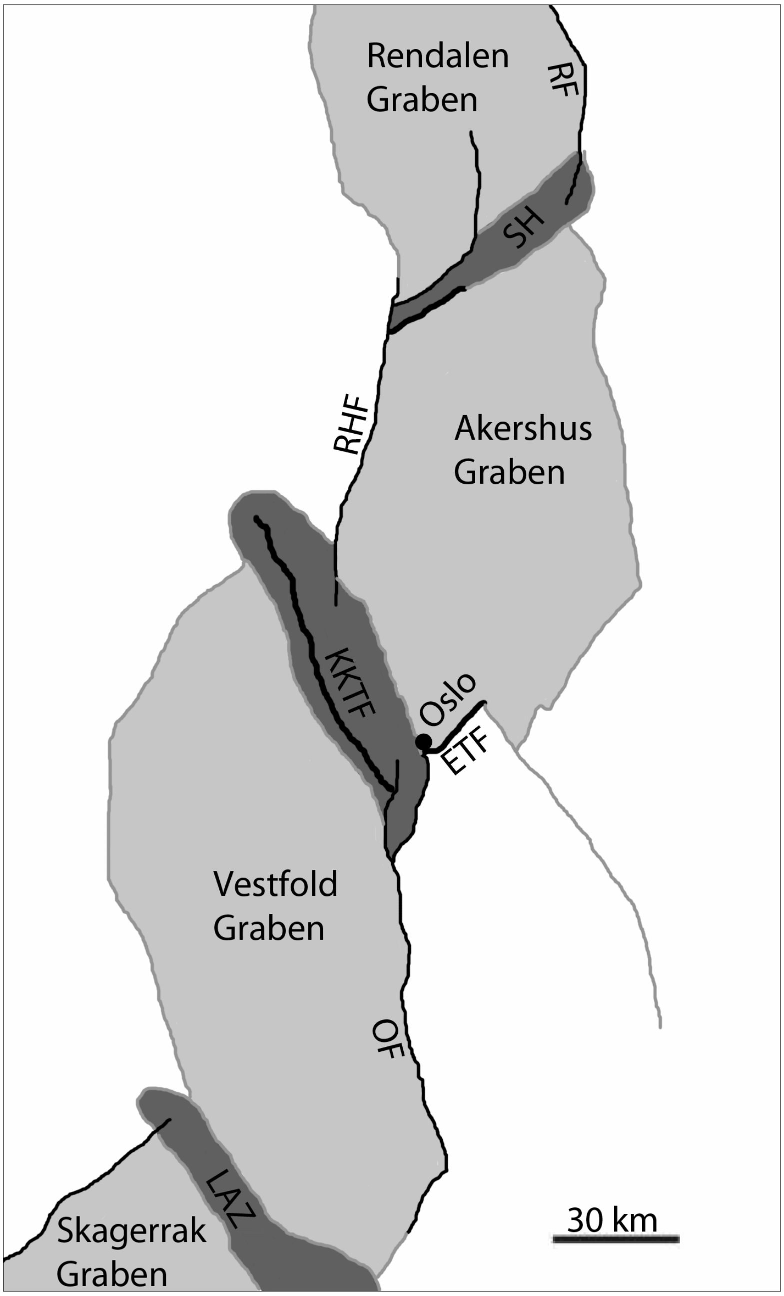

Figure 4: The Oslo Rift with graben segments, accomodation zones and master faults (after Larsen et al., 2008). LAZ – Langesund Accomodation Zone, OF – Oslofjord Fault, ETF – Ekeberg Transfer Fault, KKTF – Krokleiva-Kjaglidalen Transfer Fault, RHF – Ransfjord-Hunnselv Fault, SH – Solberg Horst, RF – Rendalen Fault.

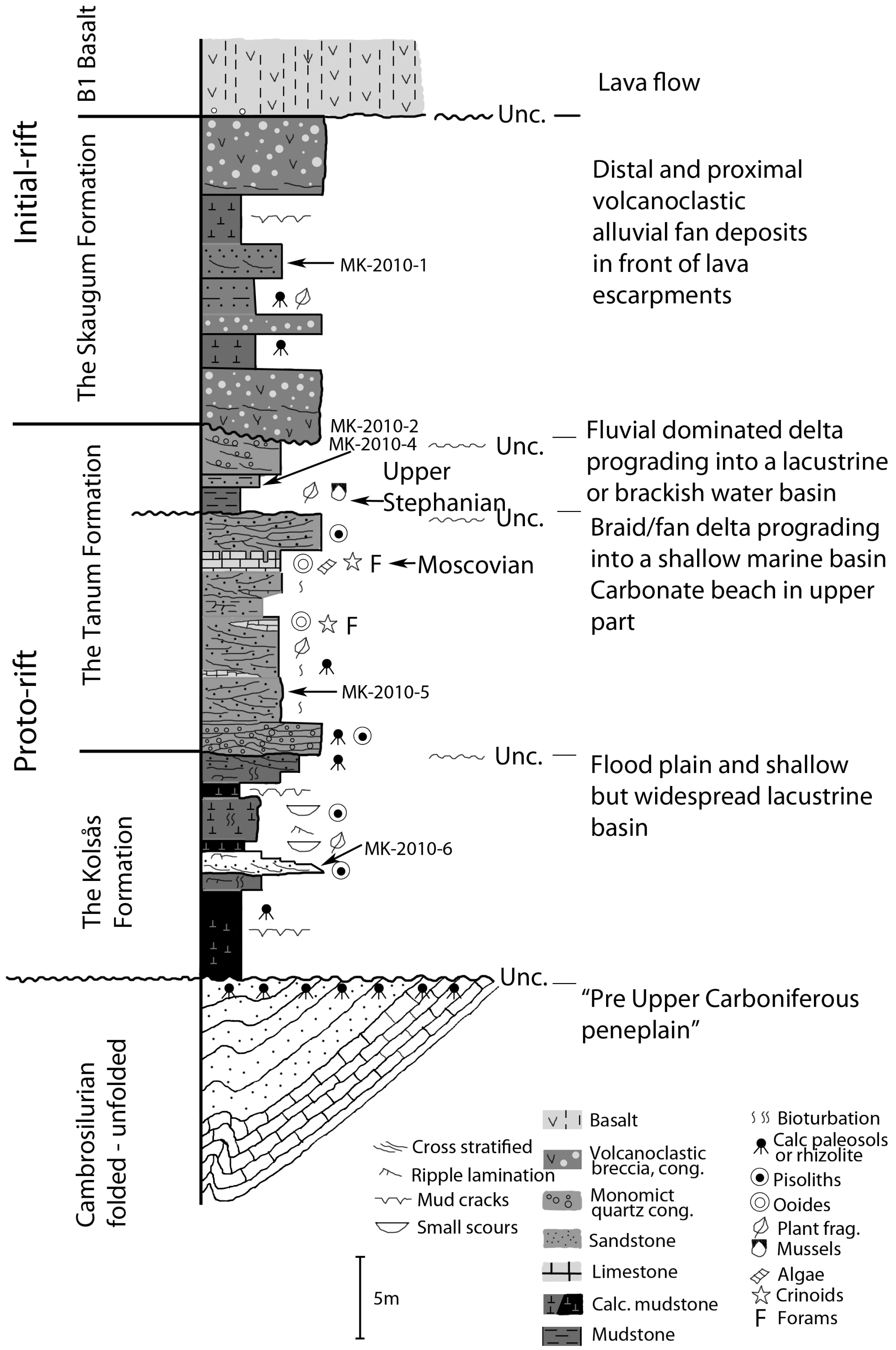

Figure 5: Overview of the stratigraphy of the Asker Group (after Larsen et al., 2008), with samples with known stratigraphic position marked.

erates and limestones (Henningsmoen, 1978; Olaussen et al., 1994). Elder and Kanes (1966, in Henningsmoen, 1978) identified anhydrite from a drill-core at Staverhagen in Bærum, pseudomorphs after evaporites have also been found (Olaussen et al., 1994), suggesting arid to semi-arid conditions. Poorly preserved *Cordaites* and *Neuropteris* type plant fossils have been found in the hillside of Kolsås (Henningsmoen, 1978).

The depositional environments have been interpreted as shallow lake, floodplain, braided stream, fluvial stream channel fill and deltaic deposits (Elder and Kanes, 1966 in Henningsmoen, 1978; Dons and Gyröy, 1967; Henningsmoen, 1978; Olaussen et al., 1994).

In addition to the central Oslo area the formation is also found in the Ringerike area (Henningsmoen, 1978) and a similar unit is found in the southernmost part of the Vestfold Graben (Olaussen and Dahlgren, 2007).

2.7.2 The Tanum Formation

In the Kolsås area the lower 5-15 m of the Tanum Formation (Fig. 5) consits of grey, often channelized, medium grained, carbonate-cemented sandstones of suggested fluvio-marine origin (Olaussen et al., 1994; Larsen et al., 2008). This unit passes upwards to bedded medium grained – occasionally with quartz pebbles – bluish sandstones (Olaussen et al., 1994). Further upwards is the 0.5-2 m thick Knabberud Limestone Member which consists of sandy biosparite, pisolitic limestone and calcareous conglomerate (Olaussen, 1981). It has been interpreted as a marine shoreline/beach deposit/calcrete deposit (Olaussen et al., 1994) of late Bashkirian to late Moscovian age (Olaussen, 1981; Larsen et al., 2008) and shows an affiliation with carbonate platform units of the same age from the Barents sea, and southern and eastern Europe (Larsen et al., 2008).

The upper part of the formation consists of a prominent conglomerate which can reach a thickness of up to 5 m in the Kolsås area (Dons and Gyröy, 1967), and is often cross stratified and interbedded with medium to very coarse grained or pebbly sandstones (Larsen et al., 2008). The pebbles in the conglomerate are usually < 10 cm in diameter, but can be over 20 cm, are subrounded-rounded with medium-high sphericity and consists mainly of quartz and quartzite (Henningsmoen, 1978).

At Hole and Ringerike an up to 3 m thick calcrete development partly replaces the conglomerate or the strata below, while finer grained lacustrine or bay deposits are seen in the Asker area with plant (Höeg, 1936), mussel (Eager, 1994) and fish (Heintz, 1934) remains suggesting a Westphalian/Stephanian age (Olaussen et al., 1994; Larsen et al., 2008).

Scattered volcanic rock fragments have been found in the formation (Elder and Kanes, 1966 in Henningsmoen, 1978) and fresh feldspar of probable volcanic origin was reported by Dons and Gyröy (1967).

The Tanum Formation has been interpreted as being deposited in a deltaic environment (Dons and Gyröy, 1967; Olaussen et al., 1994).

2.7.3 The Skaugum Formation

The Skaugum Formation (Fig. 5) is a volcanoclastic alluvial fan depositional sequence comprised of red debris flows and water laid conglomerates, calcrete beds, paleosols and laminated limestones (Olaussen et al., 1994). Low-angle cross-bedding and scour surfaces are commonly found (Henningsmoen, 1978).

Northeastward directed paleocurrents and basalt fragments with clear affinity to the alkali olivine basalt flows of the Vestfold Graben led Olaussen et al. (1994) to conclude that the alluvial fans were derived from local highs to the south.

3 Analytical Methods

3.1 Introduction

Isotopes of an element have the same number of protons and electrons, but the number of neutrons differ. This neutron difference does not change the geochemical behavior of the element, but might affect its stability. Radioactive isotopes – termed radionuclides – decay to form stable elements, in these kinds of systems the radionuclide is called the parent while the stable decay product is termed the daughter. In some decay systems (e.g. ^{235}U-^{207}Pb) the unstable parent decays to the stable radiogenic daughter by means of intermediate radionuclides – called intermediate daughters. As these intermediate daughters can have different chemical and physical characteristics (i.e. are different elements) they will respond in different manners to environmental changes.

Since the geochemical behavior of a radioactive isotopes does not change with environmental changes or time they can be used to obtain information about a geological system, e.g. U-Pb dating, or Samarium-Neodymium (Sm-Nd) or Lu-Hf used to obtain information about the petrogenesis of a rock or mineral.

3.2 Theoretical Background

3.2.1 Zircon

Zircon ($ZrSiO_4$) – an orthosilicate – is a common accessory mineral, occurring in igneous and metamorphic rocks, and subsequently in sedimentary rocks (Finch and Hanchar, 2003). It is a highly physically and chemically durable mineral, with a crystal structure which, during crystallization, favors substitution of uranium (U) for zirconium (Zr) while little to no lead (Pb) is incorporated (Speer, 1982). U is radioactive and decay to Pb, resulting in a high parent/daughter ratio in zircon at crystallization. Cherniak et al. (1997) showed that the tetravalent cations uranium and hafnium (Hf) in zircon are essentially immobile under most geologic conditions, allowing chemical zoning and isotopic signatures of inherited cores to be preserved. Commonly zircon has survived and grown during several geological events. Since the U-Pb closure temperature of an unaltered zircon is $> 900°C$ the growth domains of a zircon can preserve an isotopic record spanning millions of years (Ireland and Williams, 2003). This makes zircon an ideal candidate for U-Pb geochronology.

Zircon have complete solid-solution with hafnon ($HfSiO_4$) (Ramakrishnan et al., 1969; Hoskin and Rodgers, 1996), a typical zircon contains Hf concentration ranging between 0.5 to 7 wt% Hf (Hoskin and Schaltegger, 2003). It does incorporate some lutetium (including ^{176}Lu which is radioactive and decays to ^{176}Hf), but the amount is far less than Hf, resulting in a low Lu/Hf ratio, typically ~ 0.002 (Kinny and Maas, 2003). This makes zircon less than ideal for Lu-Hf radiometric dating, but the Lu/Hf ratio will reflect the magma from which the zircon was formed, giving information on the petrogenesis of the zircon and the host rock (Kinny and Maas, 2003).

3.2.1.1 Detrital Zircon In detrital zircon studies two approches – qualitative and quantitative – can be used (Fedo et al., 2003).

The qualitative approch seeks to find zircon with U-Pb and Hf isotope composition representative for each source component present in the sample. While in the quantitative approch the goal is that the U-Pb and Hf isotope composition of the analyzed zircons are wholly representative for the detrital zircon population of the sample (i.e. a source component comprising x% in the analyzed zircons will represent the same percentage in the zircon population as a whole; Fedo et al., 2003). Andersen (2005a) showed that 1:1 representivity is highly unlikely, unless the number of analyzed zircons (n) is unreasonably high ($n >> 100$). So a compromise between representivity, and time and resource consumption must be made; Andersen (2005a) suggests randomly picking at least 35-70 zircons and a number of non-random grains thought to represent minor and/or important components of the population. This approach was not implemented in this study, which is based on randomly picked zircons only.

Another important aspect of detrital zircon studies is the potential for bias, both natural and artificial. Zircon is more robust than the minerals making up the bulk of most sedimentary rocks (i.e. quartz and feldspar) and may have a different path through the sedimentary processes (Fedo et al., 2003). Low-uranium and young zircons might be overrepresented relative to high-uranium and old zircons which are more likely to be metamict and therefore more likely to be destroyed through abration during transportation. Standard sample preparation techniques such as Wilfley table and heavy liquid separation are generally thought not to cause an artificial bias (Fedo et al., 2003), but the Frantz magnetic separator was shown by Sircombe and Stern (2002) to be a potential source of biasing (see also Andersen et al., 2011).

3.2.2 U-Pb

Uranium has three naturally occurring radioactive isotopes: ^{235}U which decays to ^{207}Pb, ^{238}U which decays to ^{206}Pb, and ^{234}U which is an intermediate daughter of the ^{238}U decay chain. The decay systems ^{235}U-^{207}Pb and ^{238}U-^{206}Pb are used for radiometric dating. The decay of these systems can be summarized by the equations

$$^{235}\mathrm{U} \rightarrow {}^{207}\mathrm{Pb} + 7\,{}^{4}\mathrm{He} + 4\beta^{-} + Q \tag{1}$$
$$^{238}\mathrm{U} \rightarrow {}^{206}\mathrm{Pb} + 8\,{}^{4}\mathrm{He} + 6\beta^{-} + Q \tag{2}$$

where ^{4}He is an alpha particle, β^{-} a beta-minus particle and Q is the total decay energy emitted during the decay. These parent-daughter systems all undergo branched decay, but since seqular equilibrium is reached over time, they can be seen as simple parent-daughter systems (Faure and Mensing, 2005).

Uranium-lead geochronology has the advantage of using two different isotope systems which behave geochemically identical, but has different halflives (Tab. 1).

The equations describing the accumulation of Pb by decay of their respective parents are as follows

$$^{206}\mathrm{Pb} = {}^{206}\mathrm{Pb}_i + {}^{238}\mathrm{U}(e^{\lambda_{238}t} - 1) \tag{3}$$
$$^{207}\mathrm{Pb} = {}^{207}\mathrm{Pb}_i + {}^{235}\mathrm{U}(e^{\lambda_{235}t} - 1) \tag{4}$$

Isotope	Abundance (%)	Halflife (years)	Decay Constant (y^{-1})
^{235}U	0.7200	0.7038×10^9	9.8485×10^{-10}
^{238}U	99.2743	4.468×10^9	1.55125×10^{-10}

Table 1: Abundances, halflives and decay constants of naturally occurring isotopes of uranium (after Steiger and Jäger, 1977).

where λ_{238} and λ_{235} are the decay constants of ^{238}U and ^{235}U, respectively (Tab. 1), and the subscript i denotes initial Pb. For minerals such as zircon it is assumed that no lead was present at time of formation, meaning that equations 3 and 4 can be simplified to yield

$$\frac{^{206}\mathrm{Pb}*}{^{238}\mathrm{U}} = (e^{\lambda_{238}t} - 1) \tag{5}$$

$$\frac{^{207}\mathrm{Pb}*}{^{235}\mathrm{U}} = (e^{\lambda_{235}t} - 1) \tag{6}$$

where Pb$*$ represents radiogenic lead. Equations 5 and 6 can be solved for t to obtain ages, and can also be combined to yield the equation

$$\frac{^{207}\mathrm{Pb}*/^{235}\mathrm{U}}{^{206}\mathrm{Pb}*/^{238}\mathrm{U}} = \frac{e^{\lambda_{235}t} - 1}{e^{\lambda_{238}t} - 1} \quad or \quad \frac{^{207}\mathrm{Pb}*}{^{206}\mathrm{Pb}*} \times \frac{1}{137.88} = \frac{e^{\lambda_{235}t} - 1}{e^{\lambda_{238}t} - 1} \tag{7}$$

which can be solved iteratively for t if the $^{207}\mathrm{Pb}*/^{206}\mathrm{Pb}*$ ratio is measured, and the natural present day $^{238}U/^{235}U$ ratio is used. It should be noted that the the natural present day uranium ratio in current use, $^{238}U/^{235}U$ = 137.88, has recently been called into question (Brennecka et al., 2010), and a new value, which differ about 0.031% from the old value giving 0.4–0.8 Ma younger ages, has been proposed (Richter et al., 2010). Because of compatibility with U-Pb ages calculated prior to this finding, the old ratio value (137.88) will be used throughout this study.

Equations 5 and 6 will give concordant dates (i.e. the different geochronometers will give the same age) if several conditions are satisfied: i) The mineral has not gained or lost parent or (intermediate) daughter atoms except by decay of the parent to the stable daughter (i.e. the mineral has remained a closed system). ii) Correct values are used for the initial Pb isotope ratios. iii) The decay constants are known accurately. iv) No isotope fractionation of uranium or any induced fission of ^{235}U has occured. v) Analytical results are accurate and free of systematic errors (Faure and Mensing, 2005).

Uranium-lead dates are frequently discordant because of condition i) not being satisfied. This can be due to U forming the water soluable uranyl ion (UO_2^{2+}) under oxidizing conditions, loss of some of the intermediate daughters or lead loss. For condition ii) to be true corrections to the measured ^{206}Pb and ^{207}Pb must be made by estimating the amount of common lead from a general terresterial Pb evolution model. Wetherill (1956) invented the Concordia diagram which is a graphical representation of the theoretical $^{207}Pb*/^{235}U$ (horizontal axis) and $^{206}Pb*/^{238}U$ (vertical axis) ratios for any age dependent only on the decay constants. If zircon in f.ex. an igneous rock has been subjected to a disturbance of some sort (e.g. lead loss), the Concordia diagram can help visualize the timing of this event. A slightly different diagram which is especially useful to handle systems with uncorrected common lead – the Tera–Wasserburg concordia (Tera and Wasserburg, 1972) has the $^{206}Pb*/^{238}U$ ratio on the horizontal axis and the $^{207}Pb*/^{206}Pb*$ ration the vertical axis.

3.2.3 Lu-Hf

In addition to the stable naturally occurring ^{175}Lu, lutetium has a naturally occurring radioactive isotope – ^{176}Lu – which decays to stable ^{176}Hf. The equation

$$^{176}\mathrm{Lu} \rightarrow {}^{176}\mathrm{Hf} + \beta^- + \overline{\nu} + Q \tag{8}$$

where β^- represents a beta-minus particle, $\overline{\nu}$ an antineutrino and Q the total decay energy emitted, describes the decay.

The equation

$$\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}} = (\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}})_i + \frac{^{176}\mathrm{Lu}}{^{177}\mathrm{Hf}}(e^{\lambda_{^{176}Lu}t} - 1) \tag{9}$$

where ^{176}Hf/^{177}Hf and ^{176}Lu/^{177}Hf is the measured ratios of these isotopes at present time, the subscript i refers to the initial value of the ^{176}Hf/^{177}Hf ratio and $\lambda_{^{176}Lu}$ is the decay constant of ^{176}Lu ($\lambda_{^{176}Lu} = 1.867 \times 10^{-11} y^{-1}$; Scherer et al., 2001, 2007; Söderlund et al., 2004), can be used for radiometric dating. But is only applicable if the mineral or rock being dated has a high Lu/Hf ratio making the uncertainty in the assumed initial ^{176}Hf/^{177}Hf value insignificant compared to the measured ^{176}Hf/^{177}Hf value. This is not the case for zircon which generally has a low Lu/Hf ratio, but because of the low Lu/Hf ratio the Hf isotope composition of zircon change very slowly with time.

The deviation of the ^{176}Hf/^{177}Hf ratio of a zircon from the ^{176}Hf/^{177}Hf ratio of the chondritic uniform reservoir (CHUR) is expressed by the ϵ_{Hf}-value

$$\epsilon_{Hf}(t) = \left[\frac{(^{176}\mathrm{Hf}/^{177}\mathrm{Hf})^t_{sample}}{(^{176}\mathrm{Hf}/^{177}\mathrm{Hf})^t_{CHUR}} - 1\right] \times 10^4 \tag{10}$$

where $(^{176}\mathrm{Hf}/^{177}\mathrm{Hf})^t_{sample}$ is the sample ratio, $(^{176}\mathrm{Hf}/^{177}\mathrm{Hf})^t_{CHUR}$ is the ratio of CHUR, and t signifies the time at which the comparison is done. If the comparison is done at some time $t = T$ in the past, the ^{176}Hf/^{177}Hf ratio of both the sample and CHUR at time T must be found using equation 9.

Hafnium is more incompatible in mantle melting processes than lutetium, causing mantle melts to have lower Lu/Hf ratios than residual depleted mantle, thus by comparing the initial ^{176}Hf/^{177}Hf ratio of a zircon to the ^{176}Hf/^{177}Hf ratio of CHUR at the time of formation of the zircon (i.e. initial ϵ_{Hf}) an insight into its origin can be obtained; negative initial ϵ_{Hf}-values indicate derivation from a source which has lower Lu/Hf ratio than CHUR, i.e. continental crust; positive initial ϵ_{Hf}-values indicate a source with higher Lu/Hf ratios than CHUR, i.e. depleted mantle. Intermediate initial ϵ_{Hf}-values indicates a mixed magma source.

3.2.4 LAM-MC-ICPMS

A laser ablation microprobe multi-collector inductively coupled plasma mass spectrometer is, as the name suggests, a laser ablation system used in combination with an ICP ion source and a mass spectrometer.

The epoxy mouldings holding the grains are mounted in an air-thight chamber which is hooked up to a helium (He) gas line on a computer controlled moveable stage. The laser is used in combination with a digital microscope, making it easy to navigate through the samples.

When the laser beam hits the sample electrons become excited and some may be emitted from the surface. The excited electrons transfer their energy to the rest of the sample and melts and/or vaporizes it. This releases ions to form a plasma plume above the sample which leads to further melting and/or vaporization of the sample and emission of particulates, forming an aerosol (Košler and Sylvester, 2003). This aerosol is transported by the He carrier gas to the ICP, where it is ionized. The ions are then filtered by kinetic energy in an electrostatic analyzer and by mass in a magnetic sector analyzer, and subsequently measured in Faraday cups or ion counters.

Some fractionation of elements may occur as the laser pit deepens; refractory elements tend to condense on the pit wall, while this is not the case for more volatile elements. To prevent/minimize element fractionation laser craters should have high diameter-to-depth ratios (Košler and Sylvester, 2003).

3.3 Sample Preparation

Samples ranging between 3 to 7 kg were roughly cut to smaller parts, washed in running water and in an ultrasonic bath for about 10-15 minutes. The samples were left to dry in an oven at low temperature for about 15 hours. Then the samples were crushed to coarse grains (<1 cm) in a jaw crusher, and further crushed to a grainsize < 0.5 mm using a Retch percussion mill. A Wilfley shaking table was then used to separate the heavy mineral fraction from the light fraction, the heavy fraction was then further separated using heavy liquid separation. For two of the samples LST-fastfloat (sodium heteropolytungstates; 2.8 ± 0.02 g/mL) was used, for the rest sodium polytungstate (2.8 g/mL) was used. Because of the high probability of creating an artificial bias (Sircombe and Stern, 2002), a Frantz magnetic separator was only used for sample MK-2010-1.

Zircons were then picked at random using a binocular microscope and a tweezer, mounted on a plexi glass plate covered with double-sided tape, cast in an epoxy molding, and polished to expose the surface of the grains. These moldings were carbon coated for imaging in a scanning electron microscope (SEM) where cathodoluminescence (CL) images were taken.

In order to make the epoxy moldings completely clean for laser ablation inductively coupled plasma mass spectrometry analyses the carbon coating was removed with a diamond abrasive, and the epoxy moldings were washed with 2% HNO_3 in an ultrasonic bath for 15 minutes and then with MilliQ water for 15 minutes. Then the U-Pb and Lu-Hf isotope composition of the samples was analyzed using a Nu Plasma HR multi collector ICMPS and a New Wave/Merchantek LUV-213 laser ablation microprobe (LAM-MC-ICPMS).

3.4 LAM-MC-ICPMS

3.4.1 U-Pb

^{204}Pb, ^{206}Pb and ^{207}Pb were measured on secondary electron ion counters and ^{238}U was measured in a Faraday collector. Because of its low natural abundance (Tab. 1) the ^{235}U signal is usually too weak to measure with sufficient precision, therefore it was calculated from the natural ratio $^{238}\mathrm{U}/^{235}\mathrm{U} = 137.88$.

^{204}Pb was used as an indicator of common lead contamination; as mercury (Hg) in the argon gas contaminates the ^{204}Pb signal (because of isobaric interference from ^{204}Hg) on-mass background measurements were done prior to each analysis. Each measurement lasted 90 s – 30 s on-mass background measurement and 60 s static ablation. The ablation parameters were: beam diameter – 40 μm; pulse frequency – 10 Hz; beam energy density – $\geq 0.1\ \mathrm{J/cm^{-2}}$. Analysis-spots were chosen using the digital microscope and CL-images of the zircons, if a zircon had a clear core-rim structure both were analyzed if possible.

To be able to correct for U-Pb fractionation, mass spectrometer mass bias and instrumental drift two standards were analyzed two times each for every 12-15 unknowns. At the start and end of each analysis session three standards were analyzed two times each. The standards used were GJ-1 (609 ± 1 Ma; Jackson et al., 2004), 91500 (1065 ± 1 Ma; Wiedenbeck et al., 1995) and A382 (1876 ± 2 Ma; Lauri et al., 2011). In addition the inhouse reference zircon C (553 Ma; Lamminen, pers. comm) was run as an unknown; a concordia age, calculated using Isoplot (Ludwig, 2008), of 568 ± 1 Ma was obtained from the analyses of C. This concordia age is far off the concordia age obtained from ID-TIMS, but the weighted average $^{207}Pb/^{206}Pb$ age obtained from the analyses (557.3 ± 4.8 Ma) is equal within error of the weighted average $^{207}Pb/^{206}Pb$ age obtained from ID-TIMS (556.4 ± 1.5 Ma; Lamminen, pers. comm). The U-Pb data for C can be seen in Tab. 3 in the Appendix.

Raw data from the Nu software was reduced using the interactive, inhouse Excel spreadsheet NuAge.xlt. This spreadsheet does the necessary corrections – extrapolating correction factors between standard runs, allows for selection of the integration range and, if needed, common lead corrections based on the measured ^{204}Pb and the Stacey-Kramers global lead evolution curve (Stacey and Kramers, 1975) can be applied. For an in-depth explanation of the data reduction techniques see Andersen et al. (2009) and Rosa et al. (2009).

3.4.2 Lu-Hf

Masses 172-179 were measured simultaneously in Faraday collectors, using the U-Pb collector block of the Nu Plasma HR mass spectrometer. These masses represents ^{172}Yb, ^{173}Yb, ^{174}Yb, ^{174}Hf, ^{175}Lu, ^{176}Yb, ^{176}Hf, ^{176}Lu, ^{177}Hf, ^{178}Hf and ^{179}Hf. Beam parameters were: beam diameter – 55 μm; pulse frequency – 5 Hz; beam energy density – c. 2 J/cm^{-2}. Whenever possible the same spot as was analyzed for U-Pb was used. To obtain an internal precision of $\leq \pm 0.000020$ (1SE) each analysis lasted c. 180 s – 30 s on-mass background measurements and 150 s static ablation.

Isotopic ratios were calculated using the Nu Plasma time-resolved analysis software. An exponential law was used to correct the raw data for mass discrimination, the Hf mass discrimination factor was determined assuming $^{179}Hf/^{177}Hf = 0.7325$. The isobaric interference on ^{176}Hf by ^{176}Yb was corrected using the ratio $^{176}Yb/^{172}Yb = 0.58747$ (Heinonen et al., 2010), this value was obtained by multiple analyses of zircon with constant $^{176}Hf/^{177}Hf$, but variable Yb/Hf ratio to determine the $^{176}Yb/^{172}Yb$ ratio to be used in the overlap correction (Heinonen et al., 2010). To correct for the ^{176}Lu interference the ratio $^{176}Lu/^{175}Lu$ = 0.02669 (De Bièvre and Taylor, 1993) was used. Using these corrections the average initial $^{176}Hf/^{177}Hf$ ratio of the reference zircons Mud Tank and Temora-2 (Tab. 2) are comparable to the solution analyses by Woodhead and Hergt (2005) (0.282507 $\pm$ 6 and 0.282686 $\pm$ 8, respectively).

Table 2: Initial hafnium values for reference zircons.

Reference zircon		n	t (Ma)	Initial $(^{176}Hf/^{177}Hf)_t$	Initial ε_{Hf}
Mud Tank		817	732#	0.282510‡	6.6
	2SD			0.000049	1.7
Temora-2		337	418$	0.282669‡	5.2
	2SD			0.000058	2.1
LV-11*‡			290‡	0.28283‡	8.0
	2SD			0.00003	1.1

Notes: *) Solution data; ε_{Hf} calculated using CHUR-values from Bouvier et al. (2008).
References: #) Black and Gulson (1978); ‡) Heinonen et al. (2010); $) Black et al. (2003).

Reference zircons Mud Tank, Temora-2 and LV-11 were run as unknowns at regular intervals. An accuracy within $\leq \pm 0.000020$ are indicated from data obtained over a two-year period (Heinonen et al., 2010), the external reproducability (2SD) for Mud Tank and Temora-2 gives an estimated uncertainty of ± 1.7 ε-units and ± 2.1 ε-units, respectively.

A ^{176}Lu decay constant of $1.867 \times 10^{-11} y^{-1}$ (Scherer et al., 2001, 2007; Söderlund et al., 2004) was used in all calculations. The present-day CHUR parameters from Bouvier et al. (2008), $^{176}Lu/^{177}Hf = 0.0336$, $^{176}Hf/^{177}Hf = 0.282785$, were used for all ϵ_{Hf} calculations. The depleted mantle model of Griffin et al. (2000) was used to calculate model ages (T_{DM}); this model, modified to the CHUR values and decay constant used, produce a present day $^{176}Hf/^{177}Hf$ value (0.28325) similar to average mid ocean ridge basalts (MORB) over 4.56

Ga from chondritic inital ^{176}Hf/^{177}Hf and ^{176}Lu/^{177}Hf $=$ 0.0388. “Crustal” model ages (T_{DM}^{C}), assuming identical Lu/Hf ratio as average continental crust (^{176}Lu/^{177}Hf $= 0.015$; Griffin et al. 2002, 2004), were also calculated.

4 Results

4.1 Sample and sample localities

The samples were collected during the summer of 2010; samples MK-2010-1 – MK-2010-6 were collected with the help of Professor Snorre Olaussen, while sample MK-2010-7 was collected by Professor Tom Andersen. Sample localities can be seen in Fig. 6 and the position in the stratigraphic column of samples where this is known can be seen in Fig. 5.

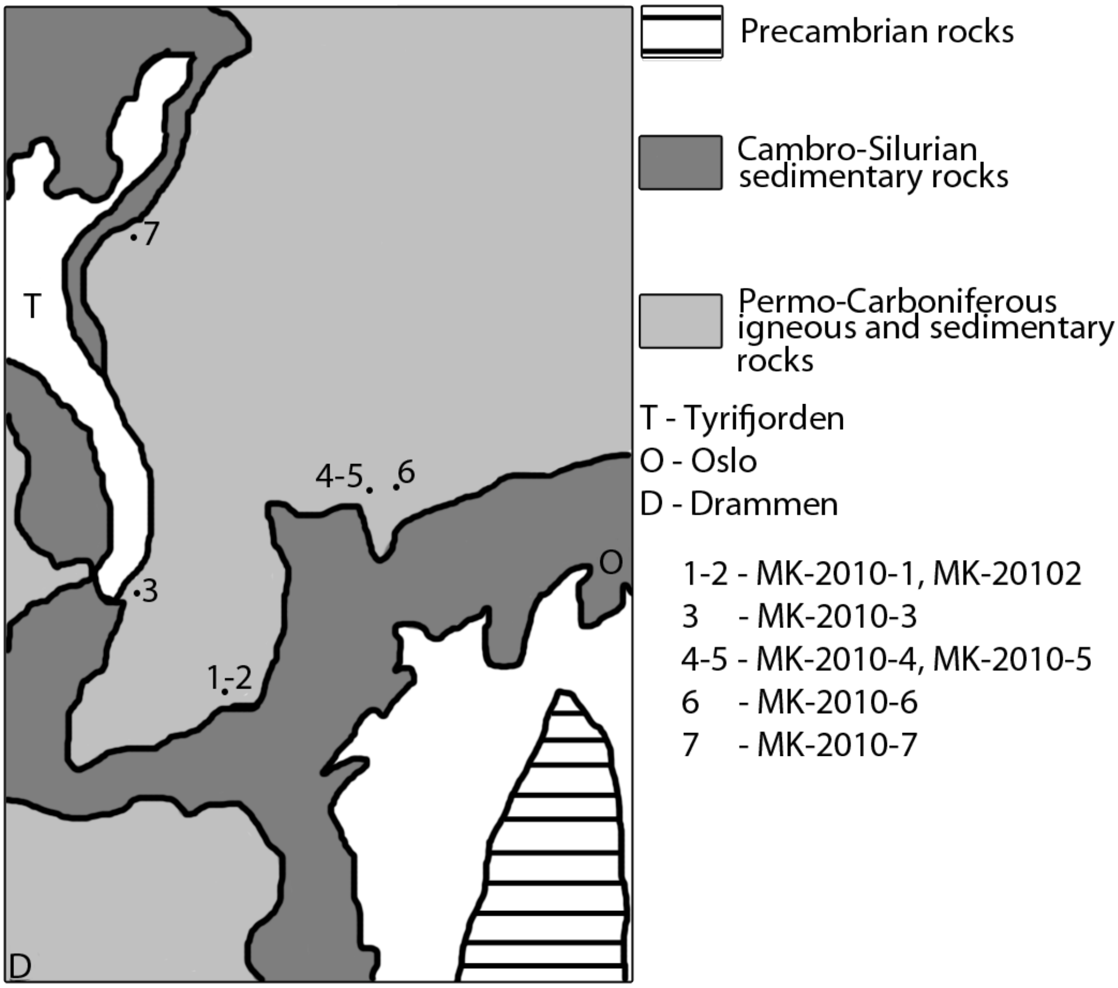

Figure 6: Simplified geological map of the study area with sample localities (modified after Olaussen, 1981).

For two samples, MK-2010-1 and MK-2010-6, only 2 and 5 zircons, respectively, were found. For these samples a characterization of the heavy minerals were obtained using SEM. For the rest of the samples, most of which belong to the Tanum Formation, large amounts of zircons were found; c. 100 grains per sample were randomly picked and used for analysis. Due to the fact that detrital zircons can be derived from vastly different sources, and the large amounts needed for provenance studies, no characterization of the zircons were attempted. CL-images of a select few zircons are shown for each sample.

4.1.1 MK-2010-1

Semsvik fossil-locality, Asker: N 59°51.348′ E 010°24.084′

This sample is a massive, volcanoclastic sandstone, belonging to the Skaugum Formation. Its heavy mineral fraction consists of mostly apatite, calcite (mostly regular, some Mg-rich), plagioclase, and minor occurrences of quartz (some pure, some Fe-coated), sheet-silicates (biotite/muscovite) and albite-quartz rock fragments.

Two zircons from the sample can be seen in Fig. 7. The image on the left shows a somewhat weakly zoned crystal, while the zircon on the right shows what could be a core surrounded by oscillatory zoning that are cut of by local recrystallization.

4.1.2 MK-2010-2

Semsvik fossil-locality, Asker: N 59°51.340′ E 010°24.107′

Sandstone, belonging to the Tanum Formation, taken right below the conglomerate.

A selection of zircons can be seen in Fig. 8. The zircon on the left is a euhedral grain with fine growth zones with possible local recrystallization in the lower left tip. The zircon on the right is a core with convolute zoning and local recrystallization surrounded by a fairly homogenous rim.

4.1.3 MK-2010-3

Kvisla, Hole: N 59°54.101′ E 010°19.533′

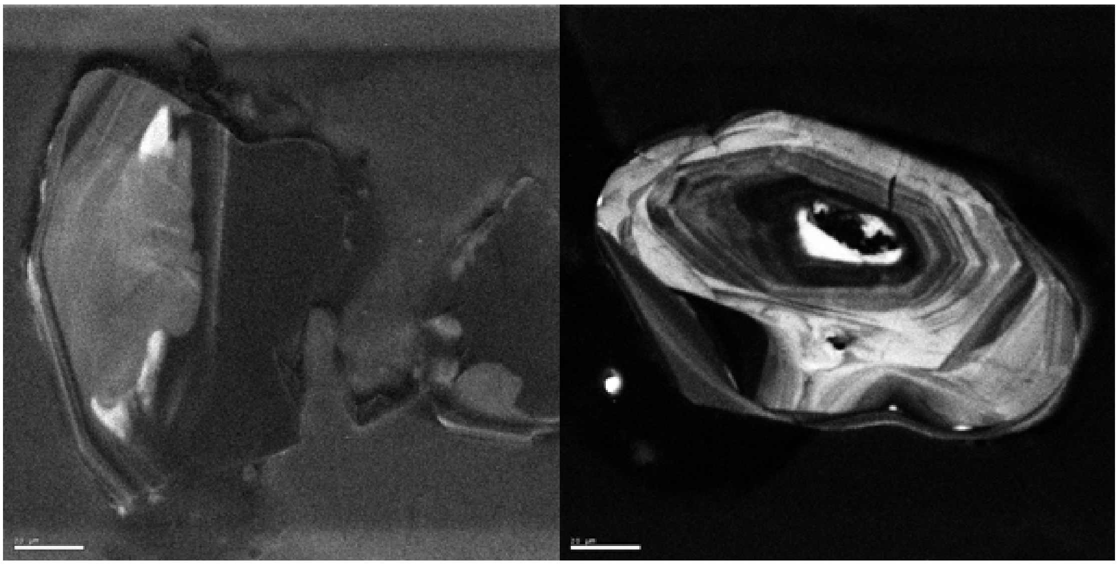

Figure 7: CL-images of zircons from MK-2010-1. Scalebar: 20 μm.

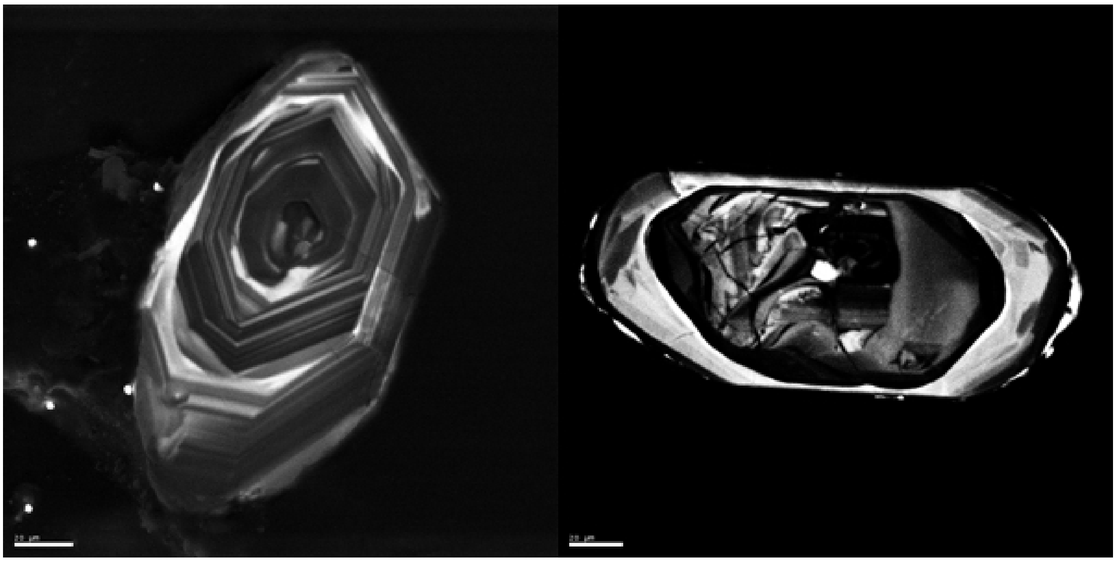

Figure 8: CL-images of zircons from MK-2010-2. Scalebar: 20 μm.

This sample is a fine-grained sandstone, overlain by conglomerate, about 3 m over the top of the Cambro-Silurian sediments. No formational subdivision has been done in this area, but the sample might belong to the Tanum Formation.

A selection of zircons can be seen in Fig. 9. The zircon on the left is oscillatory zoned, while the zircon on the right is an almost structureless homogenous grain.

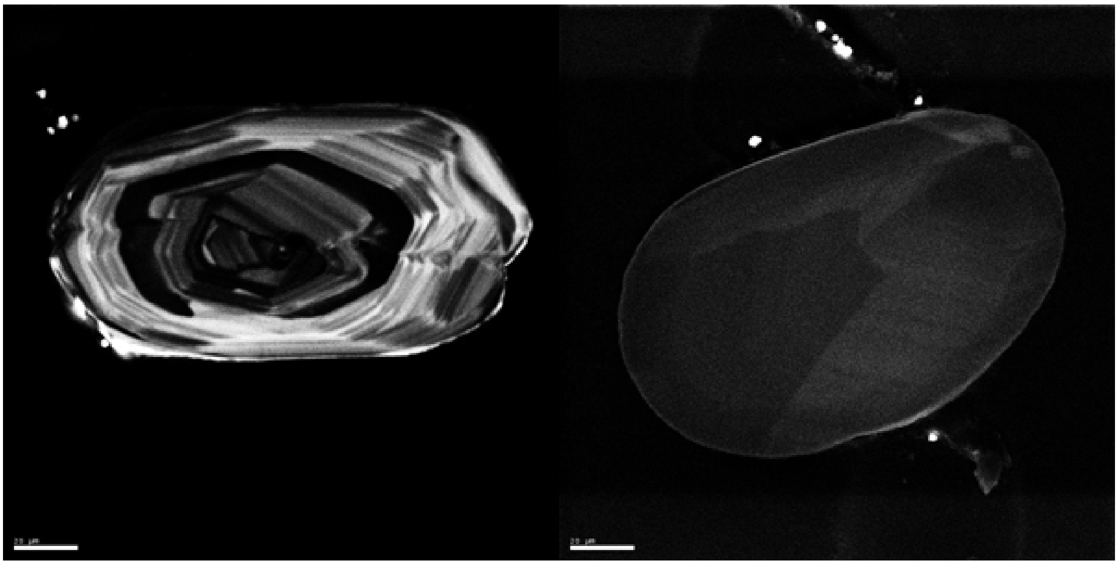

Figure 9: CL-images of zircons from MK-2010-3. Scalebar: 20 µm.

4.1.4 MK-2010-4

Løkenhavna, Bærum: N 59°55.727′ E 010°30.326′

Fine grained sandstone, below calcareous conglomerate, belonging to the upper Tanum Formation. In general the Løkenhavna area is more calcareous than the other localities.

A selection of zircons can be seen in Fig. 10. The zircon on the left is an oscillatory zoned core with a filled fracture surrounded by a homogeneous rim. The zircon on the right shows fine growth zones, inclusions and fractures.

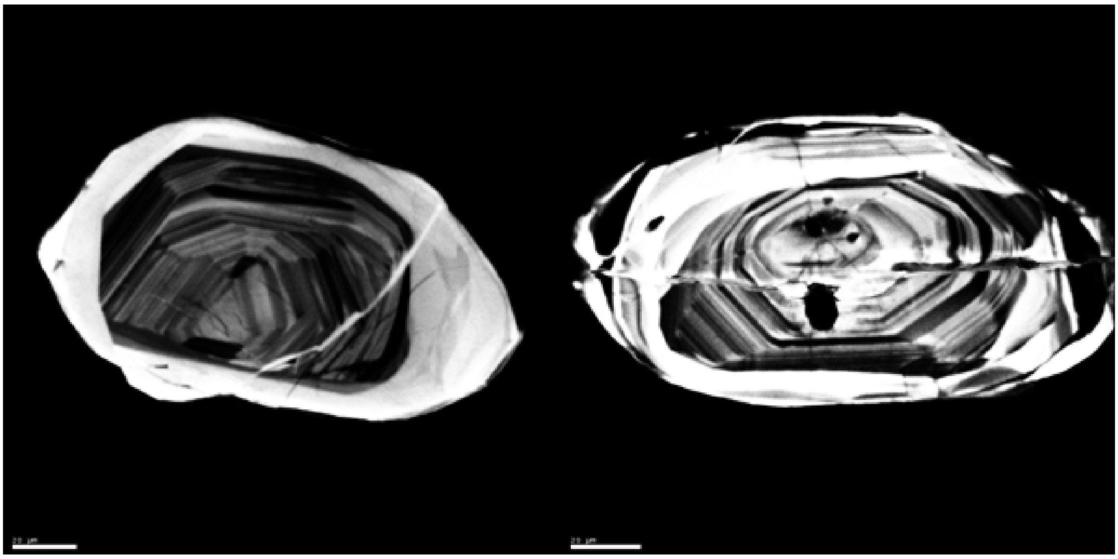

Figure 10: CL-images of zircons from MK-2010-4. Scalebar: 20 µm.

4.1.5 MK-2010-5

Løkenhavna, Bærum: N 59°55.710′ E 010°30.326′

Sandstone, the lower Tanum Formation.

A selection of zircons can be seen in Fig. 11. The zircon on the left is almost structureless and fairly homogeneous, while the zircon on the right show ocillatory zoning.

4.1.6 MK-2010-6

Knabberud, Bærum: N 59°55.789′ E 010°31.824′

Red sandstone, belonging to the Kolsås Formation, taken about 3.5 m below the bottom of the Tanum Formation. Its heavy mineral fraction consists largely of apatite, biotite, quartz and rutile. Smaller amounts of muscovite, illmenite, CrFe- and CrFeNi-minerals, and TiFe oxides were also found.

A selection of zircons can be seen in Fig. 12. The zircon on the left show some zoning around what could be a core, while the zircon on the right show clear growth zoning.

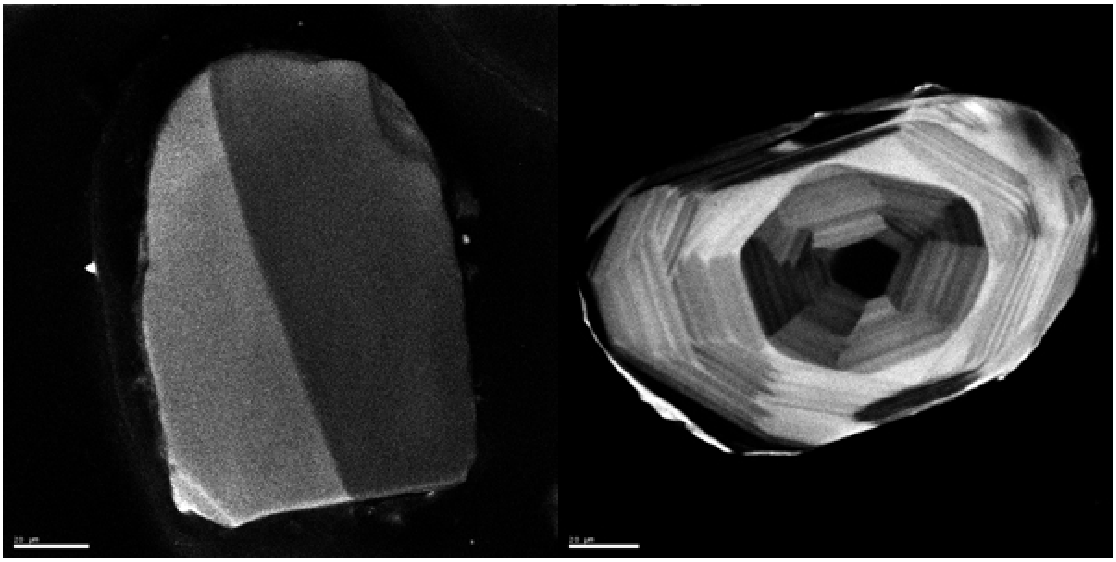

Figure 11: CL-images of zircons from MK-2010-5. Scalebar: 20 μm.

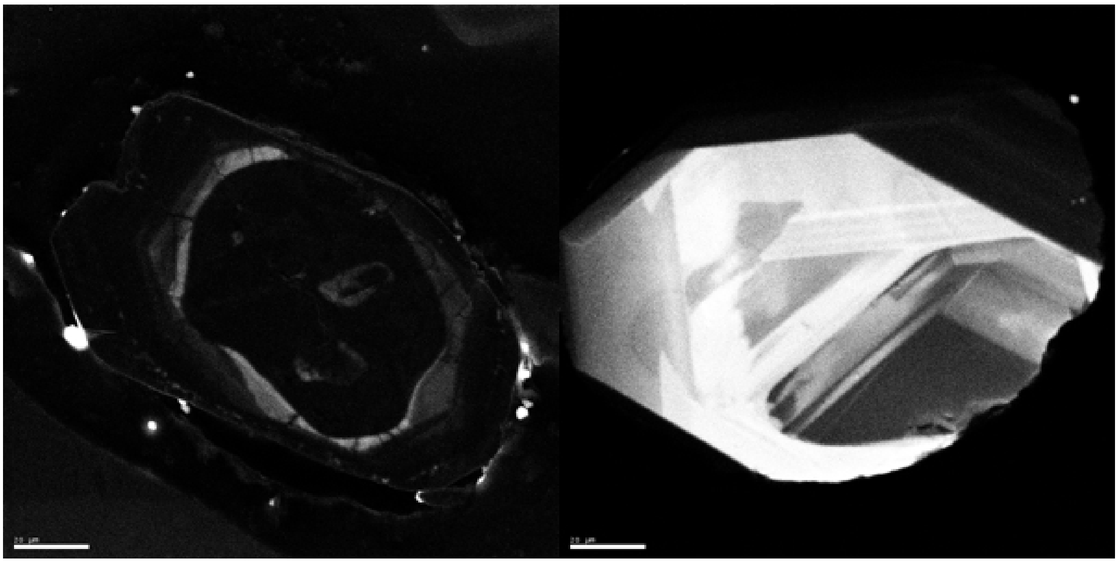

Figure 12: CL-images of zircons from MK-2010-6. Scalebar: 20 μm.

4.1.7 MK-2010-7

Dronningveien, Hole.

Cross-stratified sandstone, comprising the upper sandstone sequence; limestone below, basalt above. No formation subdivision has been done in this area.

A selection of zircons can be seen in Fig. 13. The zircon on the left is an elongated grain with a clear core, fine and somewhat broader growth zones. The zircon on the right is a round grain with several inclusions and clear growth zones.

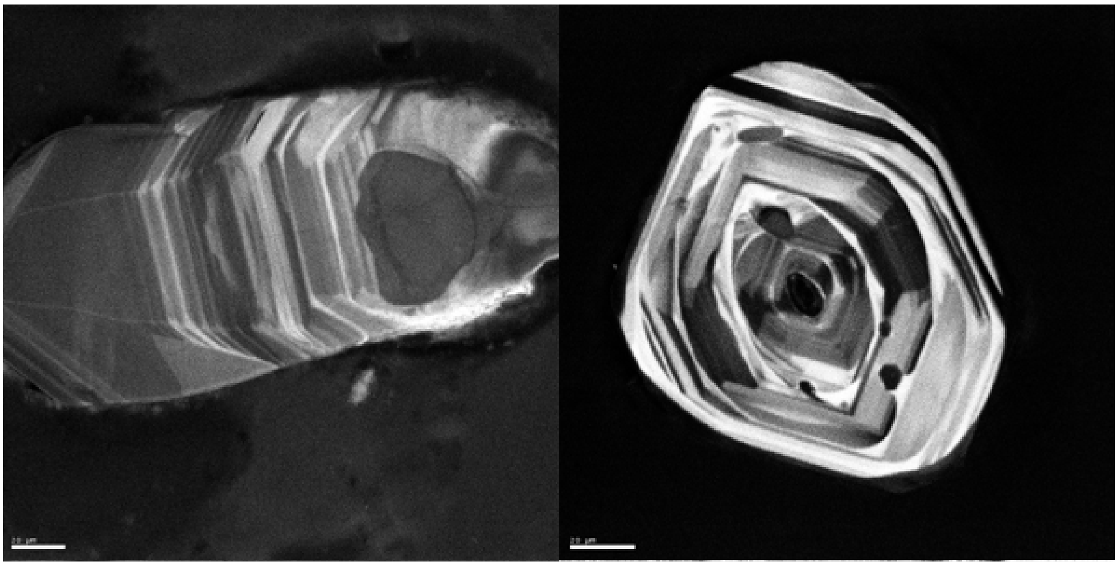

Figure 13: CL-images of zircons from MK-2010-7. Scalebar: 20 μm.

4.2 U-Pb data

For samples where large enough fractions of zircon were found probability density distribution (PDD) plots were made using R (R Development Core Team, 2008). The PDD plots use a Gaussian kernel that varies with each individual age estimate to produce a density estimate of the sample (Sircombe, 2004). This method will produce artificially high peaks if the errors are small, therefore a histogram with 100 Ma wide bins have been included in each plot. It should be noted that the ages have been binned without regard for their individual errors.

Grains outside of the 90-110% concordancy range, in the following sections referred to as discordant, are not used in PDD plots; grains in the 90-110% concordancy range are referred to as concordant; central discordance is implied when referring to discordance/concordance. When referring to ages below or equal to 600 Ma the $^{206}Pb/^{238}U$ age is used, otherwise the $^{207}Pb/^{206}Pb$ age is used.

The U-Pb data can be seen in Tab. 3–8 in the Appendix.

4.2.1 MK-2010-1

Only two grains were analyzed, of these one was sufficiently concordant and gave an age of 354 ± 4 Ma.

4.2.2 MK-2010-2

128 grains were analyzed for this sample, of these, 119 were in the 90-110% concordancy range. Ages range from 321 to 2844 Ma. A PDD plot (Fig. 14) of the data shows a maximum peak at 1630 Ma and smaller peaks at 352, 581, 938, 1028, 1129, 1183, 1444 and 1785 Ma. From the PDD plot three major age fractions can be identified: a fraction defining Sveconorwegian ages ranging from 920–1100 Ma making up 25% (n=30), a fraction also of Sveconorwegian ages ranging from 1105–1240 Ma containing 21% (n=25) and a Gothian aged fraction ranging from 1560–1710 Ma containing 20% (n=24) of the concordant grains. Smaller fractions containing 4–7% of the grains are of Carboniferous (Mississippian), early Mesoproterozoic, late Paleoproterozoic and Neo–Mesoarchean ages. Large age gaps are found from 654 to 926 Ma and 1786 to 2649 Ma. No significant change is seen if discordant data is included.

4.2.3 MK-2010-3

For this sample 113 grains were analyzed, 103 of these were sufficiently concordant. Ages range from 324 to 2243 Ma. The PDD plot in Fig. 15 shows the largest peak at 355 Ma with several smaller peaks at 600, 951, 986, 1026, 1118, 1495 and 1670 Ma. The largest age fractions identified from the PDD plot are: a fraction

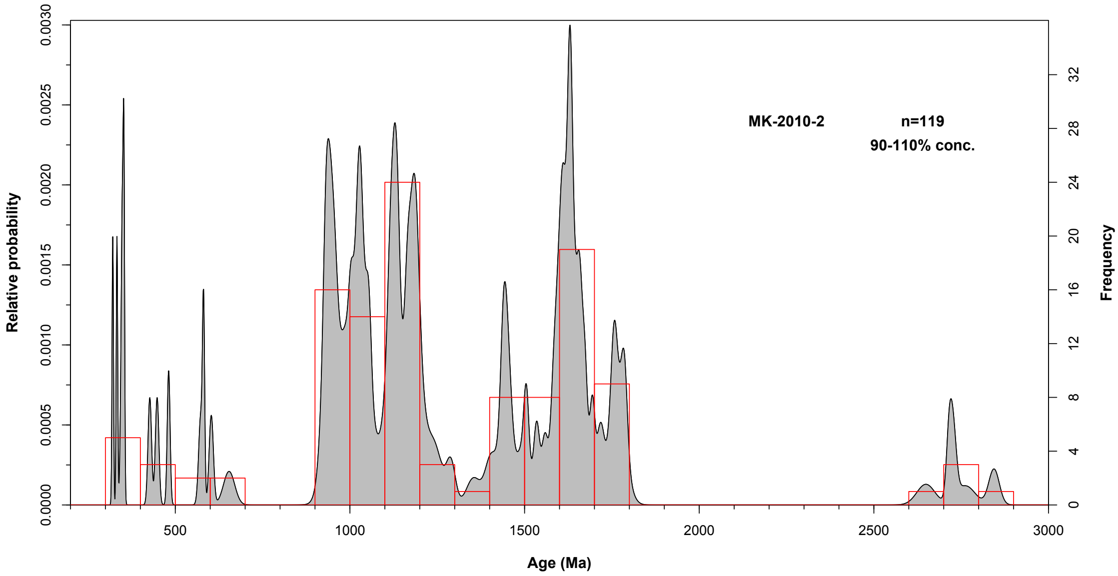

Figure 14: PDD plot of sample MK-2010-2.

of Sveconorwegian ages ranging from 900–1040 Ma containing 22% (n=23) of the total concordant grains, a Carboniferous–Devonian fraction from 324–390 Ma making up 16% (n=16), one Gothian age fraction from 1580–1780 Ma containing 14% (n=14), a Mesoproterozoic fraction from 1460–1570 Ma containing 13% (n=13) and a Sveconorwegian aged fraction ranging from 1050–1175 Ma containing 10% (n=10). A Neoproterozoic (Edicarian–Cryogenian) age fraction containing 9% (n=9) of the total population is also found. Several smaller fractions appear throughout the 324–1850 Ma age span. There is one grain of early Paleoproterozoic age (2243 Ma), while there is an age gap between 1847 and this grain. No significant change is seen if discordant data is included.

4.2.4 MK-2010-4

Of the 109 zircons analyzed for this sample, 102 were sufficiently concordant. Ages range from 440 to 1816 Ma. The PDD plot in Fig. 16 shows a maximum peak at 1041 Ma and smaller peaks at 962, 1460, 1598 and 1647 Ma. Four major age fractions can be found from the PDD plot: a Sveconorwegian age fraction ranging from 1000–1150 Ma containing 39% (n=40), a Mesoproterozoic fraction

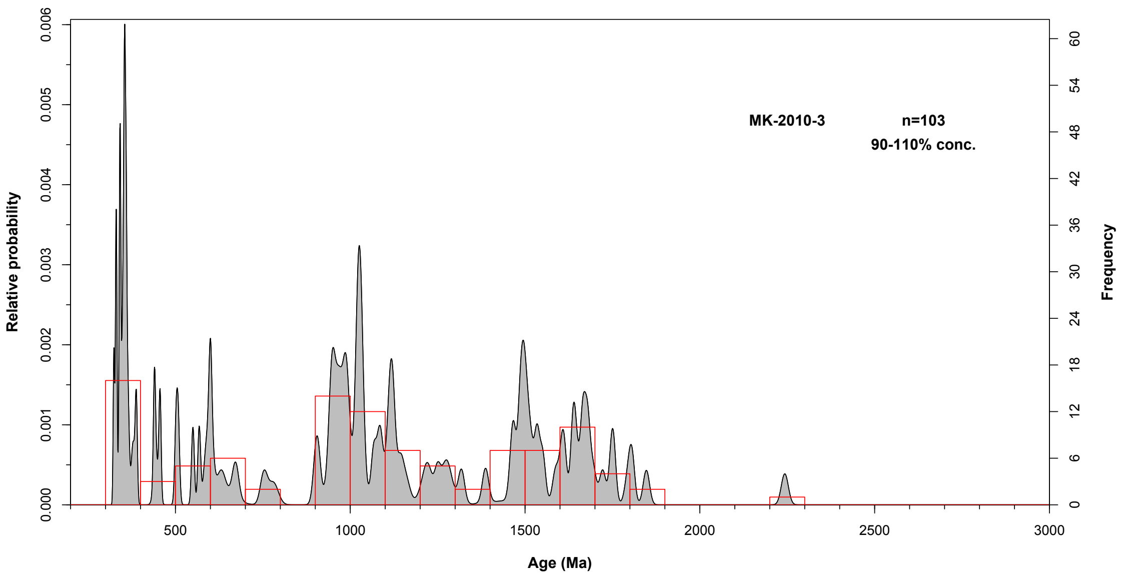

Figure 15: PDD plot of sample MK-2010-3.

from 1370–1560 Ma containing 20% (n=20), a fraction of Gothian aged zircons ranging from 1560 to 1700 Ma containing 15% (n=15) and a Sveconorwegian aged fraction ranging from 850–1000 Ma containing 11% (n=11) of the concordant grains. In addition a small 7% (n=7) Mesoproterozoic contribution from 1140–1300 Ma is also found. The only significant age gap that can be identified from the PDD plot corresponds to the Cryogenian period. No change is seen if discordant data is included.

4.2.5 MK-2010-5

For this sample 99 grains were analyzed and 94 were sufficiently concordant. Ages range from 437 to 1890 Ma, with no seemingly significant age gaps between 914 and 1890 Ma. The PDD plot of the data (Fig. 17) shows a maximum peak at 1040 Ma and smaller peaks at 447, 961, 1494, 1598, 1657 and 1795 Ma. The major age fractions identified from the PDD plot are: two fractions comprising Sveconorwegian ages ranging from 1000–1100 Ma and 900–980 Ma containing 36% (n=34) and 13% (n=12), respectively and a fraction defining Gothian ages from 1580–1670 Ma containing 10% (n=9). Smaller fractions ($\leq$ 7%) are

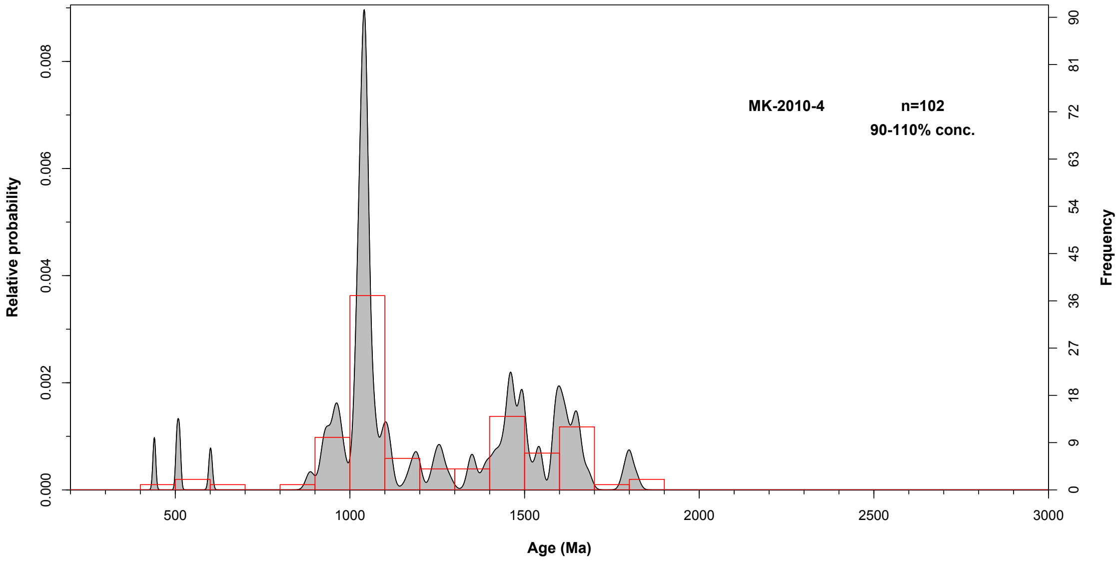

Figure 16: PDD plot of sample MK-2010-4.

found in the Silurian–Ordovician from 437–480 Ma, in the early Mesoproterozoic from 1480–1520 Ma and in the late-to-middle Paleoproterozoic from 1790–1830 Ma. Two grains of late-to-middle Neoproterozoic ages are also found. No significant change is found if discordant data is included.

4.2.6 MK-2010-6

Five zircons were analyzed, two were discarded due to discordancy, the remaining grains gave ages of 1396 ± 8 Ma, 1428 ± 9 Ma and 1855 ± 10 Ma.

4.2.7 MK-2010-7

117 grains were analyzed for this sample, 108 of these were sufficiently concordant. Ages span from 313 to 2531 Ma. The PDD plot of the data (Fig. 18) shows the, by far, largest peak at 353 Ma, smaller peaks are found at 333, 367 and 588 Ma. The only identifiable, large age fraction on the PDD is the Carboniferous–Devonian from 313-390 Ma containing 31% (n=33) of the concordant grains. Smaller age fractions occur throughout the 313–2531 Ma age range, with large

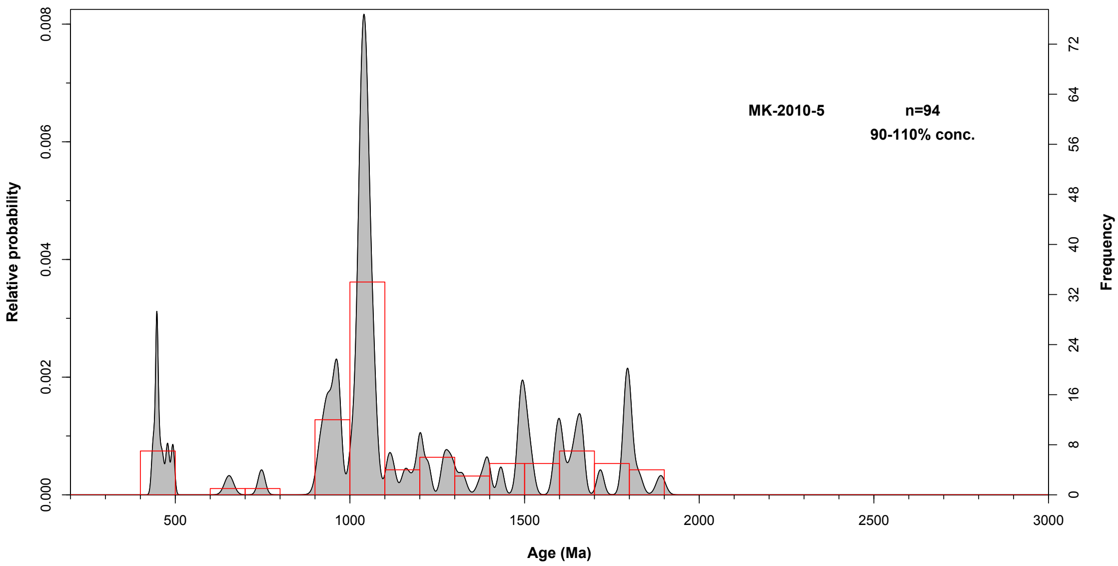

Figure 17: PDD plot of sample MK-2010-5.

age gaps from 721–898, 1792–2011 and 2084–2394. No significant change is seen if the discordant data is included.

4.3 Lu-Hf data

Because the spot size used for Lu-Hf analysis are quite large (55 μm) some of the grains were to small to analyse, this and the fact that some grains burned up during U-Pb analysis, means that the number of Hf analyses are lower than the number of U-Pb analyses. The results of the analyses can be seen in Tab. 9–14 in the Appendix. The initial ε_{Hf} is implied when referring to ε_{Hf} values.

Plots of ε_{Hf} vs. time were made, using R (R Development Core Team, 2008), for all samples except MK-2010-1 and MK-2010-6. In these plots the 2σ value of the external precision, which was calculated from the analyses of Mud Tank, is shown in the lower left corner. Individual analyses with worse precision than the external precision are shown with error bars. CHUR (Bouvier et al., 2008) and depleted mantle (Griffin et al., 2000) curves, and two lines – both with present-day $^{176}Hf/^{177}Hf = 0.28199$ – exemplifying the evolution of $^{176}Hf/^{177}Hf$

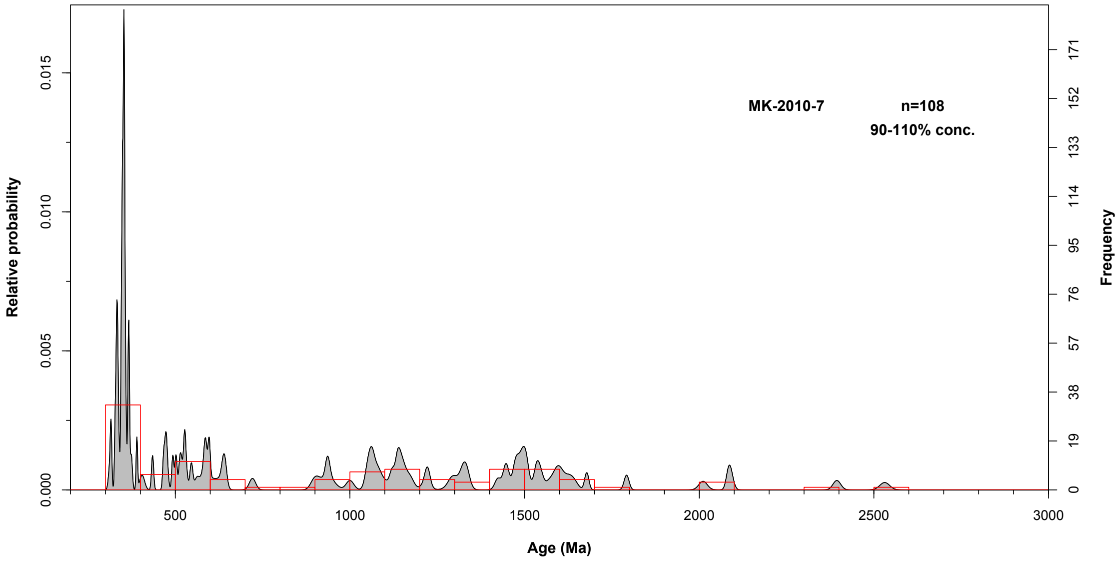

Figure 18: PDD plot of sample MK-2010-7.

with time assuming an $^{176}Lu/^{177}Hf$ ratio similar to average continental crust (0.015; Griffin et al. 2002, 2004) and assuming $^{176}Lu/^{177}Hf = 0.001$ (average value from this study), are also shown in the plots.

In the following sections a short description of the ε_{Hf} values of the grains in the major age fractions are given.

4.3.1 MK-2010-1

One zircon of Carboniferous age gave an ε_{Hf} value of -3.2.

4.3.2 MK-2010-2

Grains younger than 700 Ma range in ε_{Hf} values from -13.6 to 8.5, with most being negative. Sveconorwegian aged grains in the 920–1100 Ma age have ε_{Hf} from -6.5 to 3.8, with a slight majority (55%) being negative, while Sveconorwegian aged zircons in the 1105–1200 Ma age range are dominantly positive and range from -3.2 to 6.2. Most grains in the 1560–1710 Ma age range are positive, have ε_{Hf} values from -1.7 to 6.4 and one outlier with an ε_{Hf} value of

-25.2.

An ε_{Hf} vs. time plot can be seen in Fig. 19.

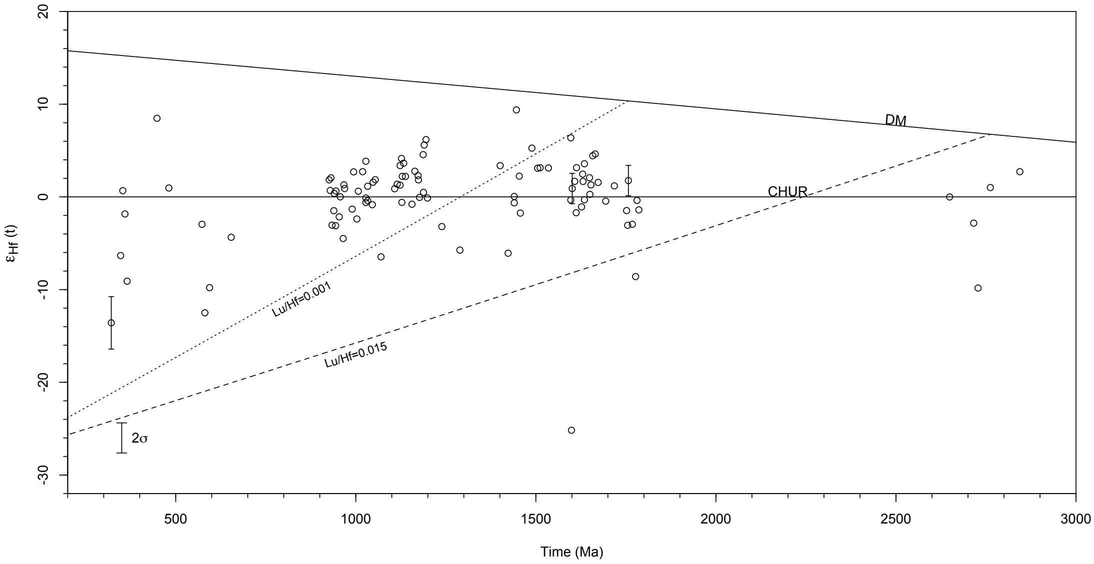

Figure 19: ε_{Hf} plot of sample MK-2010-2.

4.3.3 MK-2010-3

324–390 Ma zircons range in ε_{Hf} from -6.4 to 6.0, with most being negative. Late-to-middle Neoproterozoic grains show a large range in ε_{Hf} values (-22.6 to 10.0), while Sveconorwegian aged grains have a smaller range (-6.0 to 9.1) and are largely positive. In the 1460–1570 Ma age range the grains have ε_{Hf} values from -5.5 to 6.2, of which about half are positive.

An ε_{Hf} vs. time plot can be seen in Fig. 20.

4.3.4 MK-2010-4

Sveconorwegian aged (850–1000 Ma) zircons range in ε_{Hf} values from -3.0 to 2.4. In the 1000–1140 Ma age range the grains yield dominantly (89%) positive ε_{Hf} values and range from -5.4 to 5.4. ε_{Hf} values in the 1370–1560 Ma age range are largely positive (84%) and range from -2.3 to 4.6.

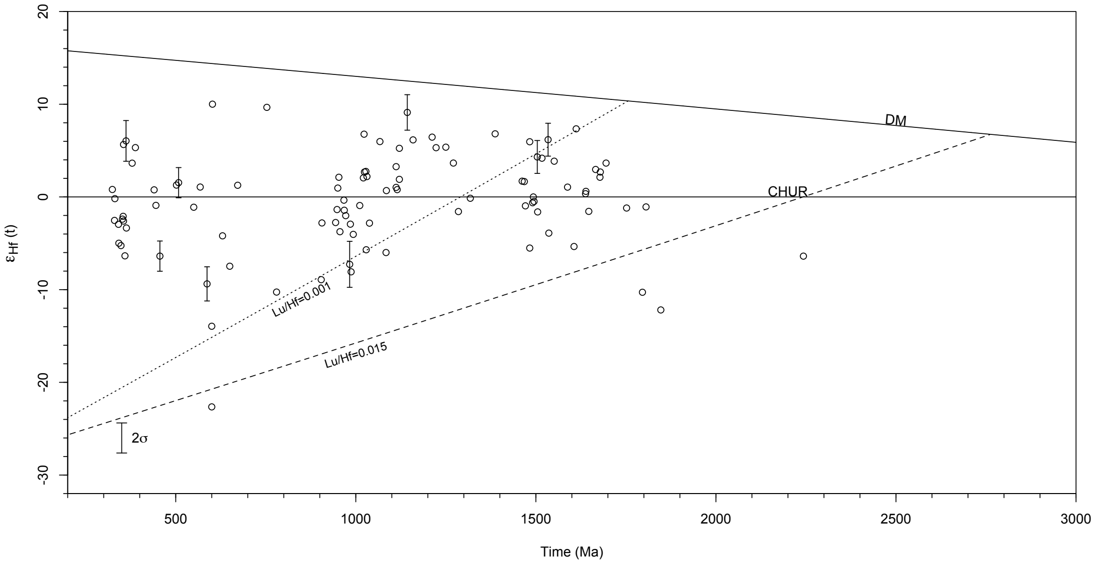

Figure 20: ε_{Hf} plot of sample MK-2010-3.

An ε_{Hf} vs. time plot can be seen in Fig. 21.

4.3.5 MK-2010-5

Sveconorwegian aged zircons in the 900–980 Ma age yield ε_{Hf} values from -6.5 to 4.4, with a slight majority (56%) being positive. Sveconorwegian zircons in the 1000–1100 Ma age range have ε_{Hf} values from -2.1 to 4.6 and are dominantly positive (83%). Gothian aged grains (1580–1670 Ma) are all positive and range from 0.3 to 7.4.

An ε_{Hf} vs. time plot can be seen in Fig. 22.

4.3.6 MK-2010-6

Of the 3 grains analyzed, two Mesoproterozoic grains have ε_{Hf} values of 0.2 and 1.9, while one Paleoproterozoic grain yield an ε_{Hf} value of -7.9.

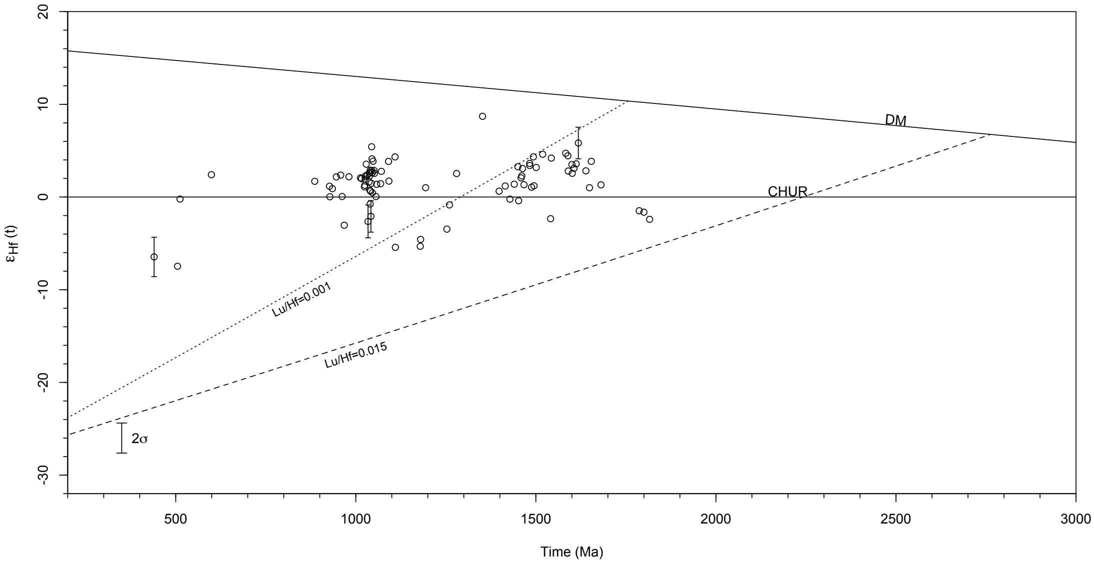

Figure 21: ε_{Hf} plot of sample MK-2010-4.

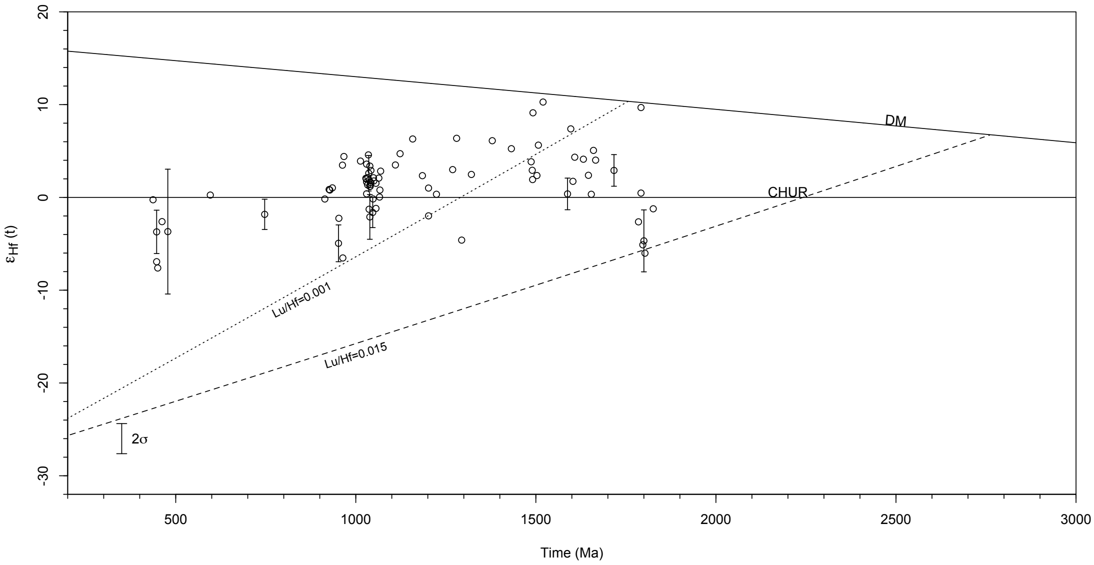

Figure 22: ε_{Hf} plot of sample MK-2010-5.

4.3.7 MK-2010-7

Zircons in the 313–390 Ma age range have ε_{Hf} from -14.9 to 7.7, and most values are negative.

An ε_{Hf} vs. time plot can be seen in Fig.23.

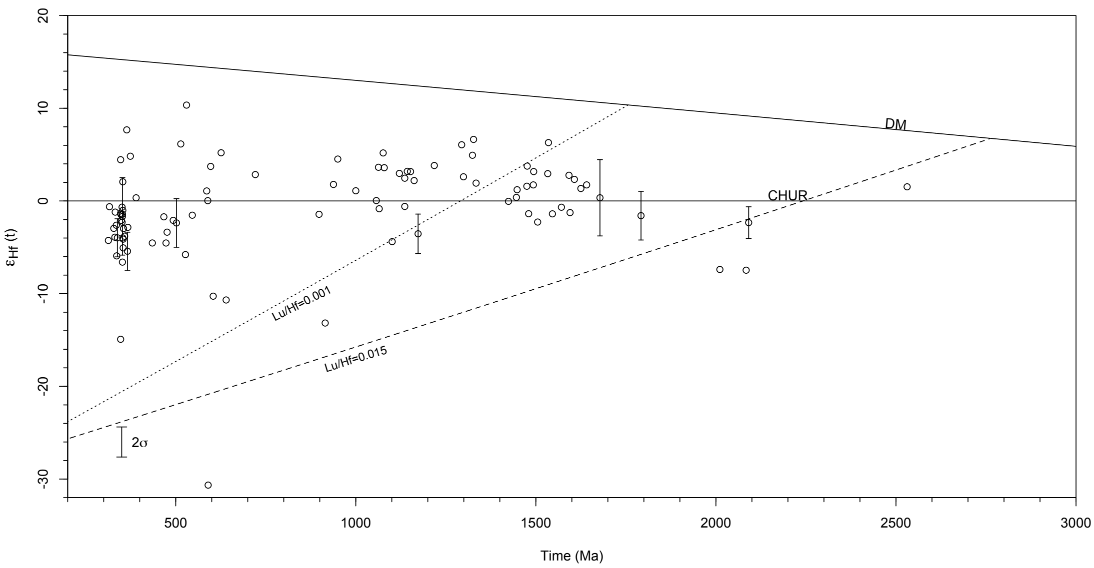

Figure 23: ε_{Hf} plot of sample MK-2010-7.

5 Discussion

5.1 Potential protosources

The location of the Oslo Rift makes the Fennoscandian Shield a natural starting point to search for potential protosources. Looking solely on the U-Pb ages, in the overall 313 ± 4 to 2844 ± 14 Ma recorded age span, it becomes apparent that the major peaks (Fig. 24) and age fractions largely coincide with known Fennoscandian crustal evolution events (Fig. 24).

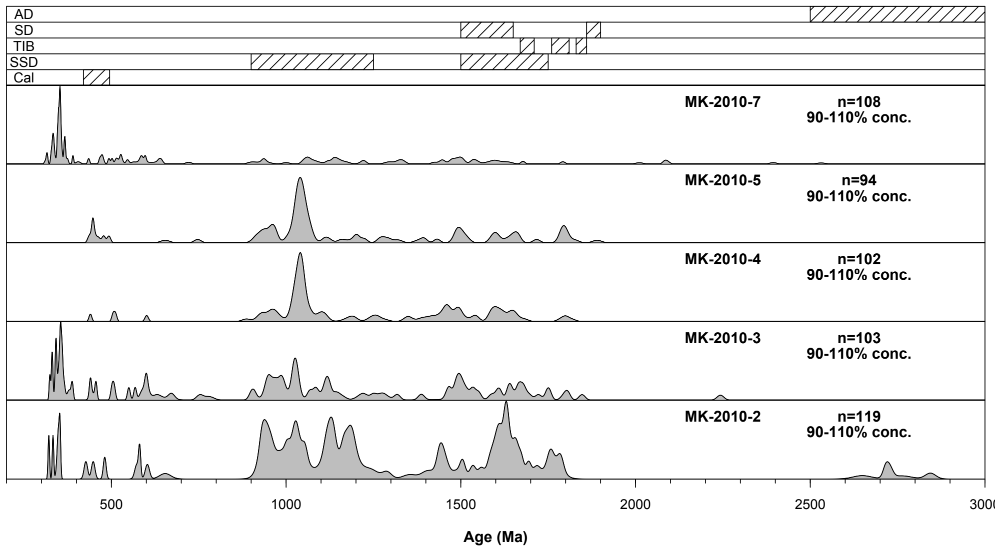

Figure 24: Combined PDD plot of all samples, with age ranges of major magmatic events in Fennoscandia. Cal (Caledonides): Gee et al. (2008). SSD (Southwest Scandinavian Domain) and SD (Svecofennian Domain): Gaál and Gorbatschev (1987). TIB (Transscandinavian Igneous Belt): Larson and Berglund (1992); Andersson et al. (2004); Gorbatschev (2004). AD (Archean Domain): Slabunov et al. (2006); Lauri et al. (2011).

Archean grains are rare, appearing only as accessories to the populations of samples MK-2010-2 and MK-2010-7. These six Neoarchean to late Mesoarchean grains range in ε_{Hf} values (Fig. 25) from -9.8 to 1.5, well within the range of similarly aged rocks from the Archean Domain of Fennoscandia (Patchett et al., 1981; Lauri et al., 2011).

A cluster of small peaks are found in the period c. 1850–1750 Ma, this period is characterized by the formation of the Transscandinavian Igneous Belt (Gorbatschev, 2004), specifically TIB-0 and TIB-1. Slightly below half of the grains found from this period plot within the evolutionary trend of TIB crust (Andersen et al., 2009), while the remaining grains, with the exception of one unusual grain plotting close to the depleted mantle curve, plot below this trend. These grains do however show similarities with Paleoproterozoic granitic intrusions within the Archean Domain (Patchett et al., 1981) and inherited zircons in TIB (Andersen et al., 2009).

In sample MK-2010-2 there is a very prominent peak at 1630 Ma, the corresponding c. 1700–1550 Ma age fraction is found in all samples, although it is not nearly as dominant as in sample MK-2010-2. In this period in time the Fennoscandian Shield was affected by the formation of TIB-2 and TIB-3 (Larson and Berglund, 1992; Andersson et al., 2004; Gorbatschev, 2004), the formation of the Rapakivi granites and associated mafic rocks in southern Finland (Heinonen et al., 2010), as well as island arc magmatism related to the Gothian Orogeny (Åhäll and Connelly, 2008). The grains falling within this age span has a fairly large ε_{Hf} range (-5.3 to 7.4), with a tendency towards juvenile composition (i.e. positive values). These values are consistant with reported values from Mid-Proterozoic calc-alkaline gneiss complexes from the Kongsberg-Marstrand, Bamble-Lillesand and Randsfjord-Lyngern blocks of the Southwestern Scandinavian Domain (Fig. 2), and late (1670 Ma) TIB granites from the southwesternmost part of the Transscandinavian Igneous Belt (Andersen et al., 2002); negative values are consistent, within error, with the evolutionary trend of TIB. One grain from this age fraction is rather conspicuous having a severly negative ε_{Hf} value (-25.2). This low radiogenic Hf content could be the result of crustal contamination of the melt from which the zircon was formed; loss of radiogenic lead from a originally Archean aged grain is also possible.

In the early Mesoproterozoic the Southwestern Scandinavian Domain was affected by voluminous magmatism in the Hardangervidda-Rogaland, Telemark, Bamble-Lillesand, Kongsberg-Marstrand and Randsfjord-Lyngern blocks (Andersen et al., 2004; Bingen et al., 2005b; Åhäll and Connelly, 2008; Bingen and Solli, 2009 and references therein). The magmatism in the Telemark block peaked at exactly 1500 Ma (Bingen et al., 2005b), and included a large sequence of bimodal volcanic rocks and correlative supracrustal rocks (Bingen and Solli, 2009). At c. 1440–1380 Ma the crust of southwestern Sweden was affected by a thermo-magmatic event termed the Hallandian (Christoffel et al., 1999; Söderlund et al., 2002). This poorly understood event has been linked to the Danopolonian Orogeny (Bogdanova et al., 2008) – a name suggested by Bogdanova (2001) for the igneous activity, metamorphism and deformation affecting the western part of the Eastern European Craton (western Fennoscandian Shield). This view was later opposed by Johansson (2009). This period is in this study represented by a small peak at c. 1500 Ma which is common for all samples and a slightly larger peak, which is only present in sample MK-2010-2, at 1444 Ma. The grains in the c. 1530–1400 Ma age fraction have ε_{Hf} varying from -6.1 to 10.3, with a vast majority (>75%) plotting on or above the CHUR curve. While no Hf isotope studies have been done on the rocks related to the Hallandian event, the general tendancy towards juvenile composition is found in c. 1527 Ma rocks just west of the Oslo Rift in the Kongsberg-Marstrand Block (Andersen et al., 2004). Similar peaks have been reported from detrital zircon from the Mesoproterozoic Rjukan Rift Basin, with ε_{Hf} from -7.9 to 8.6 (Lamminen and Köykkä, 2010).

The next significant portion of the PDD plots starts at c. 1183 Ma where a large peak is found in sample MK-2010-2, the following peak at c. 1120 Ma is found in samples MK-2010-2 and MK-2010-3. The peak at c. 1030 Ma is found in all samples except MK-2010-7, this sample does however show a small peak at c. 920 Ma which is somewhat overlapping with the other samples. These peaks are well within the c. 1300-920 Ma time period when southwestern Fennoscandia was affected by Sveconorwegian processes such as multiple episodes of magmatism – both felsic and mafic – and metamorphism (e.g. Bingen and Van Breemen, 1998; Andersen et al., 2004; Bingen et al., 2008; Pedersen et al., 2009). The almost 200 grains analyzed for Hf from this age fraction show a range in ε_{Hf} from -8.1 to 9.1, which is consistent with values reported for magmatic and inherited zircons from Sveconorwegian granitoids (Andersen et al. 2002, 2004, 2007; Pedersen et al., 2009).

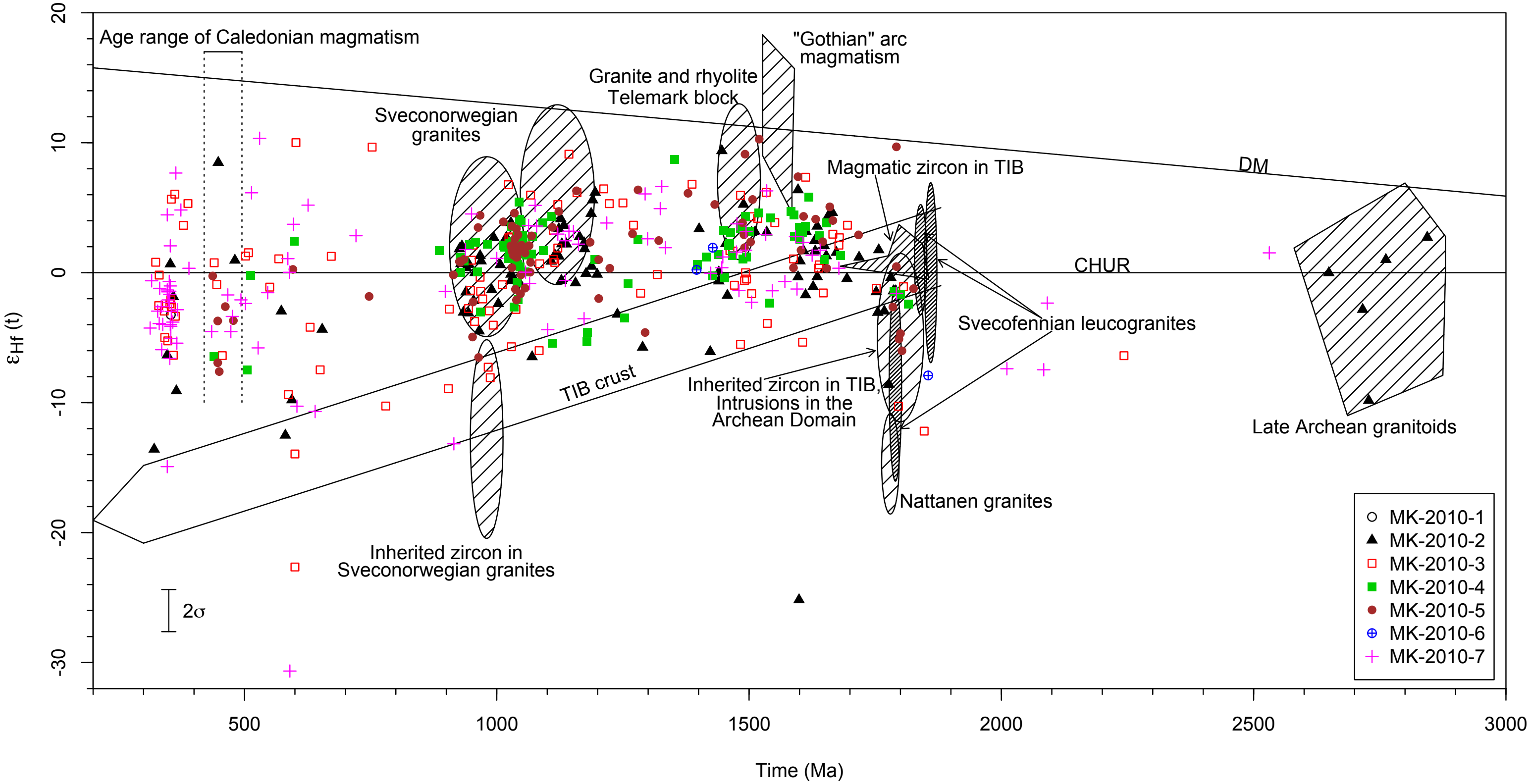

Figure 25: ε_{Hf} plot for all samples with comparative fields for magmatic rocks in Fennoscandia. Late Archean granitoids: Patchett et al. (1981); Lauri et al. (2011). Intrusions in the Archean Domain: Patchett et al. (1981). Nattanen granites: Andersen and Lauri (2010). Svecofennian leucogranites: Kurhila et al. (2010). Transscandinavian Igneous Belt, inherited zircons therein and TIB crustal evolution trend: Andersen et al. (2009). Mesoproterozoic "Gothian" arc magmatism, Telemark magmatism and Sveconorwegian granitoids: Andersen et al. (2002, 2004, 2007, 2009); Pedersen et al. (2009).

It is a characteristic property of Fennoscandia to be poor in mid-to-late Neoproterozoic magmatism (Bingen and Solli, 2009), with little to no production of zircon fertile igneous rocks occuring at this time (Andersen et al., 2011). Detrital zircons of this age have however been reported from the Neoproterozoic Hedmark Basin (Bingen et al., 2005a) and the Asker Group (Dahlgren and Corfu, 2001). Mid-to-late Neoproterozic grains are, unsurprisingly, also found in this study, where they make a fairly significant contribution (n=11) to the populations of samples MK-2010-3 and MK-2010-7, and a much smaller contribution (n$\leq$4) to samples MK-2010-2, MK-2010-4 and MK-2010-5. As discussed in Andersen et al. (2011) the Neoproterozoic grains recorded by Bingen et al. (2005a) has U-Pb ages and ^{176}Hf/^{177}Hf values fully compatible with Neoproterozoic loss of radiogenic lead in zircon from Sveconorwegian granitoids, possibly caused by surface weathering prior to deposition or by interaction with diagenetic fluids within the Hedmark Basin. While a similar radiogenic lead loss scenario is possible for some of the grains found in this study, meaning that they could be derived from the Hedmark Basin, it does not fit for grains with very low radiogenic hafnium content. These grains are however compatible with Neoproterozoic loss of radiogenic lead in zircon from Paleoproterozoic intrusions in the Archean Domain (Patchett et al., 1981). Ongoing master thesis work on the detrital zircon characteristics of the Ringerike Group by Tumseela Mubashir has recorded zircon of similar age but a more restricted ε_{Hf} range (-9.9 to -2.6; Mubashir, pers. comm.). It is therefore possible that further study of the Ringerike Group could reveal a similar ε_{Hf} range as is found in the Asker Group, which would suggest a derivation from the same source, or that the mid-to-late Neoproterozoic zircons were derived directly from the Ringerike Group. If the mid-to-late Neoproterozoic zircons are not derived from Fennoscandia a possible protosource could likely be found in the Avalonian terrane area – which stretches from southern Ireland to northwestern Germany. This area is the Neoproterozoic terrane in closest proximity to the Oslo Rift (Dahlgren and Corfu, 2001 and references therein).

The next significant peak in the PDD plots (Fig. 24), most prominent in sample MK-2010-5, appear at c. 430 Ma. This peak correspond to a the c. 495–420 Ma period when magmatism was abundant in the nappes of the Scandinavian

Caledonides (Gee et al., 2008 and references therein; Bingen and Solli, 2009 and references therein). No Lu-Hf isotope data is available from the Scandinavian Caledonides, but the ε_{Hf} values of these grains which range from -6.9 to 8.5 is overlapping with ε_{Hf} values of similarly aged detrital zircon from the Ringerike Group (Mubashir, pers. comm.).

From the latest Caledonian related magmatism to the initiation of the Oslo Rift no magmatic activity is known in Fennoscandia. Nevertheless a fairly large fraction of the zircons in this study have ages in the range c. 400–320 Ma, peaking at c. 350 Ma. This suggest a non Fennoscandian origin; the Varicides of Central Europe or the British Isles where magmatism was abundant at this time (Francis, 1988) could be a likely candidate.

5.2 Recycling of Fennoscandian sediments and input from the Variscides?

Detrital zircon with U-Pb and Lu-Hf signatures covering sources as diverse both temporally and geographically as Archean, Svecofennian, Gothian, TIB, Sveconorwegian and Caledonian terranes are unlikely to be derived directly from a single protosource. Recycling of older sediments, which could itself be the product of recycling of even older sediments, is therefore highly probable.

The age and Hf signature pattern recorded in this study shows striking recemblance with that recorded in the Silurian Ringerike Group (Mubashir pers. comm) – which is known to contain both Fennoscandian and Caledonian derived material (Dahlgren and Corfu, 2001) – and the pattern recorded in the Silurian Orsa sandstone (Andersen et al., 2011). This suggests that the bulk of the zircon detritus in the Asker Group has been derived from a Silurian sandstone similar to the Ringerike and Orsa sandstones.

Silurian sediments does naturally not contain detrital zircon younger than their depositional age, meaning that the youngest zircon fraction in this study must be derived from elsewhere. The Variscides of Central Europe and the British Isles would be a prime candidate, which could also account for the rather curious mid-to-late Neoproterozoic grain fractions. As hafnium studies from the Variscides are lacking, further source constraints proves difficult.

5.3 Youngest detrital zircon

Even though use of the youngest detrital zircon is at best a weak limit on the age of deposition of a sediment, in can in some cases give usable information (Andersen, 2005a).

The youngest concordant zircon encountered in this study yield an age of 313 ± 4 Ma, predating the iniation of Oslo Rift magmatism by approximatly 10 Ma (Corfu and Dahlgren, 2008). It could thus be derived from a hitherto unknown Oslo Rift source, possibly located in the Skagerrak Graben, or it could be derived from a southerly Variscan source.

The "Youngest detrital zircon" method in Isoplot (Ludwig, 2008), which is as the name suggests a statistically viable method for finding the youngest zircon age in a suite of detrital zircons, yields an age of $314 + 4 - 10$ Ma at the 95% confidence level. This age, along with the 313 ± 4 Ma zircon, agree with the age of the youngest grain found by (Dahlgren and Corfu, 2001) (319 ± 5; detrital zircon), and the Moscovian depositonal age, based on fossils, of the Tanum Formation (Olaussen et al., 1994).

6 Conclusion

The Asker Group sediments are hosts to a detrital zircon population with uranium-lead ages and hafnium isotope signatures consistent with virtually all pre-Oslo rift periods of major magmatic activity in Fennoscandia. The bulk of the large Archean to Carboniferous age span recorded is likely the result of recycling of a Silurian sedimentary cover sequence outside of the Oslo Rift area. Devonian-Carboniferous detritus not consistant with any rocks found in Fennoscandia must be derived from a southerly source, probably somewhere in the Variscides of Central Europe or the British Isles.

7 References

Åhäll, K.-I. and Connelly, J. N. (2008). Long-term convergence along SW fennoscandia: 330 m.y. of proterozoic crustal growth. *Precambrian Research* 161, 452–474.

Åhäll, K.-I. and Gower, C. (1997). The Gothian and Labradorian orogens: Variations in accretionary tectonism along a late Paleoproterozoic Laurentia-Baltica margin. *GFF* 119, 181–191.

Andersen, T. (2005a). Detrital zircons as tracers of sedimentary provenance: limiting conditions from statistics and numerical simulation. *Chemical Geology* 216 (3-4), 249–270.

Andersen, T. (2005b). Terrane analysis, regional nomenclature and crustal evolution in the Southwest Scandinavian Domain of the Fennoscandian Shield. *GFF* 127, 159–168.

Andersen, T. and Lauri, L. S. (2010). Variable Archean sources for Paleoproterozoic Nattanen-type granites in Northern Finland: Implications of Lu-Hf isotope data on magmatic zircon from the Riestovaara and Nattanen intrusions. *NGF abstracts and proceedings of the Geological Society of Norway 1* (29th Nordic Geological Winter Meeting, Oslo, 11–13 January, 2010).

Andersen, T., Andresen, A., and Sylvester, A. G. (2001). Nature and distribution of deep crustal reservoirs in the southwestern part of the Baltic Shield: Evidence from Nd, Sr and Pb isotope data on late Sveconorwegian granites. *Journal of the Geological Society* 158, 253–267.

Andersen, T., Griffin, W. L., and Pearson, N. J. (2002). Crustal evolution in the SW part of the Baltic Shield: The Hf isotope evidence. *Journal of Petrology* 43 (9), 1725–1747.

Andersen, T., Griffin, W. L., Jackson, S. E., Knudsen, T. L., and Pearson, N. J. (2004). Mid-Proterozoic magmatic arc evolution at the southwest margin of the Baltic Shield. *Lithos* 73, 289–318.

Andersen, T., Griffin, W. L., and Sylvester, A. G. (2007). Sveconorwegian crustal underplating in southwestern Fennoscandia: LAM-ICPMS U-Pb and Lu-Hf isotope evidence from granites and gneisses in Telemark, southern Norway. *Lithos* 93, 273–287.

Andersen, T., Andersson, U. B., Graham, S., Åberg, G., and Simonsen, S. L. (2009). Granitic magmatism by melting of juvenile continental crust: new constraints on the source of Palaeoproterozoic granitoids in Fennoscandia from Hf isotopes in zircon. *Journal of the Geological Society* 166, 233–247.

Andersen, T., Saeed, A., Gabrielsen, R. H., and Olaussen, S. (2011). Provenance characteristics of the Brumunddal sandstone in the Oslo Rift derived from U-Pb, Lu-Hf and trace element analyses of detrital zircons by laser ablation ICMPS. *Norwegian Journal of Geology* (in press).

Andersson, U. B., Sjöström, H., Högdahl, K. H. O., and Eklund, O. (2004). The Transscandinavian Igneous Belt, Evolutionary Models. *In* Högdahl, K., Andersson, U. B., and Eklund, O. (eds.). *The Transscandinavian Igneous Belt (TIB) in Sweden: a review of its character and evolution*. Geological Survey of Finland, Special Paper 37. Geological Survey of Finland, 104–112.

Baker, J. H., Hellingwerf, R. H., and Oen, I. S. (1988). Structure, stratigraphy and ore-forming processes in Bergslagen: implications for the development of the Svecofennian of the Baltic Shield. *Geologie & mijnbouw* 67, 121–138.

Berthelsen, A. (1980). Towards a palinspastic tectonic analysis of the Baltic Shield. *In* Cogne, J. and Slansky, M. (eds.). *Geology of Europe, from Precambrian to the post-Hercynian sedimentary basins*. Memoires du B. R. G. M., 5–21.

Bingen, B. and Solli, A. (2009). Geochronology of magmatism in the Caledonian and Sveconorwegian belts of Baltica: synopsis for detrital zircon provenance studies. *Norwegian Journal Of Geology* 89, 267–290.

Bingen, B. and Van Breemen, O. (1998). Tectonic regimes and terrane boundaries in the high-grade Sveconorwegian belt of SW Norway, inferred from U-Pb zircon geochronology and geochemical signature of augen gneiss suites. *Journal of the Geological Society* 155, 143–154.

Bingen, B., Griffin, W. L., Torsvik, T. H., and Saeed, A. (2005a). Timing of Late Neoproterozoic glaciation on Baltica constrained by detrital zircon geochronology in the Hedmark Group, south-east Norway. *Terra Nova* 17, 250–258.

Bingen, B., Skår, Ø., Marker, M., Sigmond, E. M. O., Nordgulen, Ø., Ragnhildstveit, J., Mansfeld, J., Tucker, R. D., and Liégeois, J. P. (2005b). Timing of continental building in the Sveconorwegian orogen, SW Scandinavia. *Norwegian Journal Of Geology* 85, 87–116.

Bingen, B., Davis, W. J., Hamilton, M. A., Engvik, A. K., Stein, H. J., Skar, Ø., and Nordgulen, Ø. (2008). Geochronology of high-grade metamorphism in the Sveconorwegian belt, S. Norway: U-Pb, Th-Pb and Re-Os data. *Norwegian Journal Of Geology* 88, 13–42.

Black, L. P. and Gulson, B. L. (1978). The age of the Mud Tank Carbonatite, Strangways Range, Northern Territory. *BMR Journal of Australian Geology and Geophysics* 3, 227–232.

Black, L. P., Kamo, S. L., Allen, C. M., Aleinikoff, J. N., Davis, D. W., Korsch, R. J., and Foudoulis, C. (2003). TEMORA 1: a new zircon standard for Phanerozoic U-Pb geochronology. *Chemical Geology* 200, 155–170.

Bogdanova, S. V., Bingen, B., Gorbatschev, R., Kheraskova, T. N., Kozlov, V. I., Puchkov, V. N., and Volozh, Y. A. (2008). The East European Craton (Baltica) before and during the assembly of Rodinia. *Precambrian Research* 160, 23–45.

Bogdanova, S. (2001). Tectonic Settings of 1.65-1.4 Ga AMCG Magmatism in the Western East European Craton (Western Baltica). *Journal of Conference Abstracts* 6 (1), 769 (SS02).

Bouvier, A., Vervoort, J. D., and Patchett, P. J. (2008). The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets. *Earth and Planetary Science Letters* 273 (1-2), 48–57.

Brennecka, G. A., Weyer, S., Wadhwa, M., Janney, P. E., Zipfel, J., and Anbar, A. D. (2010). $^{238}U/^{235}U$ Variations in Meteorites: Extant ^{247}Cm and Implications for Pb-Pb Dating. *Science* 327 (5964), 449–451.

Cherniak, D. J., Hanchar, J. M., and Watson, E. B. (1997). Diffusion of tetravalent cations in zircon. *Contributions to Mineralogy and Petrology* 127 (4), 383–390.

Christoffel, C. A., Connelly, J. N., and Åhäll, K.-I. (1999). Timing and characterization of recurrent pre-Sveconorwegian metamorphism and deformation in the Varberg–Halmstad region of SW Sweden. *Precambrian Research* 98, 173–195.

Corfu, F. and Dahlgren, S. (2008). Perovskite U-Pb ages and the Pb isotopic composition of alkaline volcanism initiating the Permo-Carboniferous Oslo Rift. *Earth And Planetary Science Letters* 265, 256–269.

Dahlgren, S. and Corfu, F. (2001). Northward sediment transport from the late Carboniferous Variscan Mountains: zircon evidence from the Oslo Rift, Norway. *Journal of the Geological Society* 158, 29–36.

Daly, S., Balagansky, V. V., Timmerman, M. J., and Whitehouse, M. J. (2006). The Lapland-Kola orogen: Palaeoproterozoic collision and accretion of the northern Fennoscandian lithosphere. *In* Gee, D. G. and Stephenson, R. A. (eds.). *European Lithosphere Dynamics*. The Geological Society of London Memoirs 32. The Geological Society of London, 579–598.

Davies, N. S., Turner, P., and Sansom, I. J. (2005). A revised stratigraphy for the Ringerike Group (Upper Silurian, Oslo Region). *Norwegian Journal Of Geology* 85 (3), 193–202.

De Bièvre, P. and Taylor, P. D. P. (1993). Table of the isotopic compositions of the elements. *International Journal of Mass Spectrometry and Ion Processes* 123, 149–166.

Dons, J. A. and Gyröy, E. (1967). Permian Sediments, lavas and faults in the Kolsås area W. of Oslo. *Norsk Geologisk Tidsskrift* 47, 57–77.

Eager, R. M. C. (1994). Non-marine bivalve assemblage in the Asker Group, Oslo Graben and its correlation with a late Pennsylvanian assemblage from North America. *Journal of the Geological Society* 151, 669–680.

Faure, G. and Mensing, T. M. (2005). *Isotopes: Principles and Applications*. 3rd ed. John Wiley & Sons Inc., 2005. 897 pp.

Fedo, C. M., Sircombe, K. N., and Rainbird, R. H. (2003). Detrital zircon analysis of the sedimentary record. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 277–303.

Finch, R. J. and Hanchar, J. M. (2003). Structure and chemistry of zircon and zircon-group minerals. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 1–25.

Francis, E. H. (1988). Mid-Devonian to early Permian volcanism: Old World. *In* Harris, A. L. and Fettes, D. J. (eds.). *The Caledonian–Appalachian Orogen*. The Geological Society of London Special Publications 38. The Geological Society of London, 573–584.

Gaál, G. (1990). Tectonic styles of Early Proterozoic ore deposition in the Fennoscandian shield. *Precambrian Research* 46, 83–114.

Gaál, G. and Gorbatschev, R. (1987). An Outline of the Precambrian Evolution of the Baltic Shield. *Precambrian Research* 35, 15–52.

Gee, D. G., Fossen, H., Henriksen, N., and Higgins, A. K. (2008). From the Early Paleozoic Platforms of Baltica and Laurentia to the Caledonide Orogen of Scandinavia and Greenland. *Episodes* 31 (1), 44–51.

Gorbatschev, R. (2004). The Transscandinavian Igneous Belt – introduction and background. *In* Högdahl, K., Andersson, U. B., and Eklund, O. (eds.). *The Transscandinavian Igneous Belt (TIB) in Sweden: a review of its character and evolution*. Geological Survey of Finland, Special Paper 37. Geological Survey of Finland, 9–15.

Gorbatschev, R. and Bogdanova, S. (1993). Frontiers in the Baltic Shield. *Precambrian Research* 64, 3–21.

Griffin, W. L., Pearson, N. J., Belousova, E., Jackson, S. E., van Achterbergh, E., O'Reilly, S. Y., and Shee, S. R. (2000). The Hf isotope composition of cratonic mantle: LAM-MC-ICPMS analysis of zircon megacrysts in kimberlites. *Geochimica et Cosmochimica Acta* 64 (1), 133–147.

Griffin, W. L., Wang, X., Jackson, S. E., Pearson, N. J., O'Reilly, S. Y., Xu, X. S., and Zhou, X. M. (2002). Zircon chemistry and magma mixing, SE China: In-situ analysis of Hf isotopes, Tonglu and Pingtan igneous complexes. *Lithos* 61, 237–269.

Griffin, W. L., Belousova, E. A., Shee, S. R., Pearson, N. J., and O'Reilly, S. Y. (2004). Archean crustal evolution in the northern Yilgam Craton: U-Pb and Hf-isotope evidence from detrital zircons. *Precambrian Research* 131, 231–282.

Heeremans, M., Larsen, B. T., and Steel, H. (1996). Paleostress reconstruction from kinematic indicators in the Oslo Graben, southern Norway. New constraints on the mode of rifting. *Tectonophysics* 266, 55–79.

Heeremans, M., Timmerman, M. J., Kirstein, L. A., and Faleide, J. I. (2004). New constraints on the timing of late Carboniferous-early Permian volcanism in the central North Sea. *In* Wilson, M., Neumann, E.-R., Davies, G. R., Timmerman, M. J., Heeremans, M., and Larsen, B. T. (eds.). *Permo-Carboniferous Magmatism and Rifting in Europe*. Geological Society, London, Special Publications 223. The Geological Society of London, 157–176.

Heinonen, A. P., Andersen, T., and Rämö, O. T. (2010). Re-evaluation of Rapakivi Petrogenesis: Source Constraints from the Hf Isotope Composition of Zircon in the Rapakivi Granites and Associated Mafic Rocks of Southern Finland. *Journal Of Petrology* 51 (8), 1687–1709.

Heintz, A. (1934). Fischreste aus dem Unterperm Norwegens. *Norsk Geologisk Tidsskrift* 14, 176–194.

Henningsmoen, G. (1978). Sedimentary Rocks Associated with the Oslo Region Lavas. *In* Dons, J. A. and Larsen, B. T. (eds.). *The Oslo Paleorift: A Review and Guide to Excursions*. Norges Geologiske Undersøkelse Bulletin 337. Norges Geologiske Undersøkelse, 17–24.

Höeg, O. A. (1936). The Lower Permian flora of the Oslo region. *Norsk Geologisk Tidsskrift* 16, 1–43.

Hölttä, P., Balagansky, V., Garde, A. A., Mertanen, S., Peltonen, P., Slabunov, A., Sorjonen-Ward, P., and Whitehouse, M. (2008). Archean of Greenland and Fennoscandia. *Episodes* 31 (1), 13–19.

Hoskin, P. W. O. and Rodgers, K. A. (1996). Raman spectral shift in the isomorphous series $(Zr_{1-x}Hf_x)SiO_4$. *European Journal of Solid State and Inorganic Chemistry* 33, 1111–1121.

Hoskin, P. W. O. and Schaltegger, U. (2003). The composition of zircon and igneous and metamorphic petrogenesis. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 27–62.

Ireland, T. R. and Williams, I. S. (2003). Consideration in zircon geochronology by SIMS. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 215–241.

Jackson, S. E., Pearson, N. J., Griffin, W. L., and Belousova, E. A. (2004). The application of laser ablation-inductively coupled plasma-mass spectrometry to in situ U-Pb zircon geochronology. *Chemical Geology* 211 (1-2), 47–69.

Johansson, Å. (2009). Baltica, Amazonia and the SAMBA connection-1000 million years of neighbourhood during the Proterozoic? *Precambrian Research* 175, 221–234.

Kinny, P. D. and Maas, R. (2003). Lu-Hf and Sm-Nd isotope systems in zircon. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 305–326.

Korja, A., Lahtinen, R., and Nironen, M. (2006). The Svecofennian orogen: a collage of microcontinents and island arcs. *In* Gee, D. G. and Stephenson, R. A. (eds.). *European Lithosphere Dynamics*. The Geological Society of London Memoirs 32. The Geological Society of London, 561–578.

Korja, T., Smirnov, M., Pedersen, L. B., and Gharibi, M. (2008). Structure of the Central Scandinavian Caledonides and the underlying Precambrian basement, new constraints from magnetotellurics. *Geophysical Journal International* 175, 55–69.

Košler, J. and Sylvester, P. J. (2003). Present Trends and the Future of Zircon in Geochronology: Laser Ablation ICPMS. *In* Hanchar, J. M. and Hoskins, P. W. O. (eds.). *Zircon*. Reviews in mineralogy and geochemistry 53. Mineralogical Society of America, 243–275.

Kurhila, M., Andersen, T., and Rämö, O. T. (2010). Diverse sources of crustal granitic magma: Lu-Hf isotope data on zircon in three Paleoproterozoic leucogranites of southern Finland. *Lithos* 115, 263–271.

Lahtinen, R. (1994). Crustal evolution of the Svecofennian and Karelian domains during 2.1-1.79 Ga, with special emphasis on the geochemistry and origin of 1.93-1.91 Ga gneissic tonalites and associated supracrustal rocks in the Rautalampi area, central Finland. *Geological Survey of Finland, Bulletin* 378, 128 pp.

Lahtinen, R., Korja, A., and Nironen, M. (2005). Paleoproterozoic tectoic evolution. *In* Lehtinen, M., Nurmi, P. A., and Rämö, O. T. (eds.). *Precambrian Geology of Finland – Key to the Evolution of the Fennoscandian Shield*. Developments in Precambrian Geology 14. Elsevier B. V., 481–532.

Lahtinen, R., Garde, A. A., and Melezhik, V. A. (2008). Paleoproterozoic evolution of Fennoscandia and Greenland. *Episodes* 31 (1), 20–28.

Lahtinen, R., Hölttä, P., Kontinen, A., Niiranen, T., Nironen, M., Saalmann, K., and Sorjonen-Ward, P. (2011). Tectonic and metallogenic evolution of the Fennoscandian shield: key questions with emphasis on Finland. *In* Nenonen, K. and Nurmi, P. A. (eds.). *Geoscience for Society 125th Anniversary Volume*. Geological Survey of Finland, Special Paper 49. Geological Survey of Finland, 23–33.

Lamminen, J. and Köykkä, J. (2010). The provenance and evolution of the Rjukan Rift Basin, Telemark, south Norway: The shift from a rift basin to an epicontinental sea along a Mesoproterozoic supercontinent. *Precambrian Research* 181 (1-4), 129–149.

Larsen, B. T., Olaussen, S., Sundvoll, B., and Heeremans, M. (2006). Vulkaner, forkastninger og ørkenklima. *In* Ramberg, I. B., Bryhni, I., and Nøttvedt, A. (eds.). *Landet blir til*. Norsk Geologisk Forening, 284–327.

Larsen, B. T., Olaussen, S., Sundvoll, B., and Heeremans, M. (2008). The Permo-Carboniferous Oslo Rift through six stages and 65 million years. *Episodes* (1), 52–58.

Larson, S. Å. and Berglund, J. (1992). A chronological subdivision of the Transscandinavian Igneous Belt – three magmatic episodes? *GFF* 114, 459–461.

Lauri, L. S., Andersen, T., Hölttä, P., Huhma, H., and Graham, S. (2011). Evolution of the Archaean Karelian Province in the Fennoscandian Shield in the light of U-Pb zircon ages and Sm-Nd and Lu-Hf isotope systematics. *Journal of the Geological Society* 168, 201–218.

Ludwig, K. R. (2008). User's manual for Isoplot 3.70 - A Geochronological Toolkit for Microsoft Excel. *Berkley Geochronology Center Special Publication No. 4*.

McCann, T., Pascal, C., Timmerman, M. J., Krzywiec, P., López-Gómez, J., Wetzel, A., Krawczyk, C. M., Rieke, H., and Lamarche, J. (2006). Post-Variscan (end Carboniferous-Early Permian) basin evolution in Western and Central Europe. *In* Gee, D. G. and Stephenson, R. A. (eds.). *European Lithosphere Dynamics*. The Geological Society of London Memoirs 32. The Geological Society of London, 355–388.

Mutanen, T. and Huhma, H. (2003). The 3.5 Ga Siurua trondhjemite gneiss in the Archaean Pudasjärvi Granulite Belt, northern Finland. *Bulletin of the Geological Society of Finland* 75 (1-2), 51–68.

Naterstad, J. (1978). Excursion 2. Nittedal cauldron (Anlsjøen area). *In* Dons, J. A. and Larsen, B. T. (eds.). *The Oslo Paleorift: A Review and Guide to Excursions*. Norges Geologiske Undersøkelse Bulletin 337. Norges Geologiske Undersøkelse, 99–104.

Neumann, E.-R., Olsen, K. H., Baldridge, W. S., and Sundvoll, B. (1992). The Oslo Rift – A Review. *Tectonophysics* 208 (1-3), 1–18.

Nironen, M. (1997). The Svecofennian Orogen: a tectonic model. *Precambrian Research* 86, 21–44.

Olaussen, S. (1981). Marine incursion in Upper Palaeozoic sedimentary rocks of the Oslo Region, Southern Norway. *Geological Magazine* 118 (3), 281–288.

Olaussen, S. and Dahlgren, S. (2007). Environmental setting of the southernmost outcrop of the Carboniferous in the Oslo Rift. An arid syn-tectonic lacustrine and alluvial deposit with possible marine incursions. *In* Nakrem, H. A. (ed.). *Vinterkonferansen 2007*. 1. Abstracts and Proceedings of the Geological Society of Norway, 70–71.

Olaussen, S., Larsen, B. T., and Steel, R. (1994). The Upper Carboniferous-Permian Oslo Rift; Basin Fill In Relation To Tectonic Development. *Canadian Society Of Petroleum Geologist Memoirs* 17, 175–197.

Patchett, P. J., Kouvo, O., Hedge, C. E., and Tatsumoto, M. (1981). Evolution of Continental Crust and Mantle Heterogeneity: Evidence from Hf Isotopes. *Contributions To Mineralogy And Petrology* 78, 279–297.

Pedersen, S., Andersen, T., Konnrup-Madsen, J., and Griffin, W. L. (2009). Recurrent mesoproterozoic continental magmatism in South-Central Norway. *International Journal Of Earth Sciences* 98, 1151–1171.

R Development Core Team (2008). *R: A Language and Environment for Statistical Computing*. ISBN 3-900051-07-0. R Foundation for Statistical Computing. Vienna, Austria, 2008. URL: `http://www.R-project.org`.

Ramakrishnan, S. S., Gokhale, K. V. G. K., and Subbarao, E. C. (1969). Solid solubility in the system zircon-hafnon. *Materials Research Bulletin* 4, 323–328.

Ramberg, I. B. and Larsen, B. T. (1978). Tectonomagmatic Evolution. *In* Dons, J. A. and Larsen, B. T. (eds.). *The Oslo Paleorift: A Review and Guide to Excursions*. Norges Geologiske Undersøkelse Bulletin 337. Norges Geologiske Undersøkelse, 55–73.

Richter, S., Eykens, R., Kühn, H., Aregbe, Y., Verbruggen, A., and Weyer, S. (2010). New average values for the n(^{238}U)/n(^{235}U) isotope ratios of natural uranium standards. *International Journal of Mass Spectrometry* 295 (1-2), 94–97.

Ro, H. E., Stuevold, L. M., Faleide, J. I., and Myhre, A. M. (1990a). Skagerrak Graben – the offshore continuation of the Oslo Graben. *Tectonophysics* 178 (1), 1–10.

Ro, H. E., Larsson, F. R., Kinck, J. J., and Husebye, E. S. (1990b). The Oslo Rift – its evolution on the basis of geological and geophysical observations. *Tectonophysics* 178 (1), 11–28.

Roberts, D. and Gee, D. G. (1985). An introduction to the structure of the Scandinavian Caledonides. *In* Gee, D. G. and Sturt, B. A. (eds.). *The Caledonide Orogen – Scandinavia and Related Areas*. John Wiley & Sons Ltd., 55–68.

Rosa, D. R. N., Finch, A. A., Andersen, T., and Inverno, C. M. C. (2009). U-Pb geochronology and Hf isotope ratios of magmatic zircons from the Iberian Pyrite Belt. *Mineralogy And Petrology* 95, 47–69.

Scherer, E., Munker, C., and Mezger, K. (2001). Calibration of the lutetium-hafnium clock. *Science* 293 (5530), 683–687.

Scherer, E., Munker, C., and Mezger, K. (2007). The Lu-Hf systematics of meteorites: Consistent or not. *Goldschmidt Conference Abstracts 2007. Geochimica et Cosmochimica Acta* 71 (15S), A888.

Sircombe, K. N. (2004). AgeDisplay: an EXCEL workbook to evaluate and display univariate geochronological data using binned frequency histograms and probability density distributions. *Computers & Geosciences* 30 (1), 21–31.

Sircombe, K. N. and Stern, R. A. (2002). An investigation of artificial biasing in detrital zircon U-Pb geochronology due to magnetic separation in sample preparation. *Geochimica et Cosmochimica Acta* 66 (13), 2379–2397.

Slabunov, A. I., Lobach-Zhuchenko, S. B., Bibikova, E. V., Sorjonen-Ward, P., Balagansky, V. V., Volodichev, O. I., Shchipansky, A. A., Svetov, S. A., Chekulaev, V. P., Arestova, N. A., and Stepanov, V. S. (2006). The Archean nucleus of the Fennoscandian (Baltic) Shield. *In* Gee, D. G. and Stephenson, R. A. (eds.). *European Lithosphere Dynamics*. The Geological Society of London Memoirs 32. The Geological Society of London, 627–644.

Söderlund, U., Möller, C., Andersson, J., Johansson, L., and Whitehouse, M. (2002). Zircon geochronology in polymetamorphic gneisses in the Sveconorwegian orogen, SW Sweden: ion microprobe evidence for 1.46-1.42 and 0.98-0.96 Ga reworking. *Precambrian Research* 113, 193–225.

Söderlund, U., Patchett, J. P., Vervoort, J. D., and Isachsen, C. E. (2004). The ^{176}Lu decay constant determined by Lu-Hf and U-Pb isotope systematics of Precambrian mafic intrusions. *Earth and Planetary Science Letters* 219 (3-4), 311–324.

Söderlund, U., Isachsen, C. E., Bylund, G., Heaman, L. M., Jonathan Patchett, P., Vervoort, J. D., and Andersson, U. B. (2005). U-Pb baddeleyite ages and Hf, Nd isotope chemistry constraining repeated mafic magmatism in the Fennoscandian Shield from 1.6 to 0.9 Ga. *Contributions to Mineralogy and Petrology* 150 (2), 174–194.

Speer, J. A. (1982). Zircon. *In* Ribbe, P. H. (ed.). *Orthosilicates*. 2nd ed. Reviews in Mineralogy 5. Mineralogical Society of America, 67–112.

Stacey, J. S. and Kramers, J. D. (1975). Approximation of terrestrial lead isotope evolution by a two-stage model. *Earth And Planetary Science Letters* 26, 207–221.

Steiger, R. H. and Jäger, E. (1977). Subcommission on geochronology: convention on the use of decay constants in geo- and cosmochronology. *Earth and Planetary Science Letters* 36 (3), 359–362.

Tera, F. and Wasserburg, G. J. (1972). U-Th-Pb systematics in three apollo 14 basalts and the problem of initial Pb in lunar rocks. *Earth and Planetary Science Letters* 14 (3), 281–304.

Torske, T. (1985). Terrain displacement and Sveconorwegian rotation of the Baltic Shield: A working hypothesis. *In* Tobi, A. C. and Touret, J. L. R. (eds.). *The Deep Proterozoic Crust in the North Atlantic Provinces*. NATO Advanced Study Institute Series, series C 158. Dordrecht: D. Reidel Publishing Company, 333–343.

Wetherill, G. W. (1956). Discordant Uranium-Lead Ages, I. *Transactions, American Geophysical Union* 37 (3), 320–326.

Wiedenbeck, M., Alle, P., Corfu, F., Griffin, W. L., Meier, M., Oberli, F., Vonquadt, A., Roddick, J. C., and Speigel, W. (1995). Three natural zircon standards for U-Th-Pb, Lu-Hf, trace element and REE analyses. *Geostandards Newsletter* 19 (1), 1–23.

Woodhead, J. D. and Hergt, J. M. (2005). A Preliminary Appraisal of Seven Natural Zircon Reference Materials for In Situ Hf Isotope Determination. *Geostandards And Geoanalytical Research* 29 (2), 183–195.

Ziegler, P. A., Schumacher, M. E., Dèzes, P., Wees, J. D. V., and Cloetingh, S. (2006). Post-Variscan evolution of the lithosphere in the area of the European Cenozoic Rift System. *In* Gee, D. G. and Stephenson, R. A. (eds.). *European Lithosphere Dynamics*. The Geological Society of London, Memoirs 32. The Geological Society of London, 97–112.

8 Appendix

Table 3: U-Pb data for C, MK-2010-1 and MK-2010-6

Name	U ppm	^{206}Pb ppm	$^{206}Pb_c$* (%)	Ratios $\frac{^{206}Pb}{^{204}Pb}$	Ratios $\frac{^{207}Pb}{^{206}Pb}$	Ratios 1σ	Ratios $\frac{^{207}Pb}{^{235}U}$	Ratios 1σ	Ratios $\frac{^{206}Pb}{^{238}U}$	Ratios 1σ	Rho	Disc.‡ C.	Disc.‡ Min.	Ages (Ma) $\frac{^{207}Pb}{^{206}Pb}$	Ages (Ma) 1σ	Ages (Ma) $\frac{^{207}Pb}{^{235}U}$	Ages (Ma) 1σ	Ages (Ma) $\frac{^{206}Pb}{^{238}U}$	Ages (Ma) 1σ
C-101108-MK01	479	41	.	8021	0.05825	0.00024	0.74137	0.00589	0.09230	0.00063	0.859	5.8	2.0	539	9	563	3	569	4
C-101108-MK-101	477	37	.	9842	0.05865	0.00026	0.74437	0.00767	0.09204	0.00086	0.905	2.5	.	554	9	565	4	568	5
C-101108-MK-201	473	38	.	12001	0.05922	0.00031	0.74218	0.00646	0.09089	0.00063	0.795	-2.6	.	575	11	564	4	561	4
C-101012-MK-01	375	26	.	7782	0.05848	0.00034	0.73863	0.00883	0.09160	0.00095	0.872	3.2	.	548	12	562	5	565	6
C-101012-MK001	454	40	.	8818	0.05869	0.00058	0.75082	0.01029	0.09278	0.00088	0.691	3.0	.	556	22	569	6	572	5
C-101015-MK01	415	38	.	9071	0.05881	0.00025	0.75808	0.00897	0.09349	0.00103	0.931	3.0	.	560	9	573	5	576	6
C-101015-MK101	412	32	.	21862	0.05878	0.00024	0.75216	0.00631	0.09281	0.00068	0.877	2.5	.	559	9	569	4	572	4
C-101018-MK101	414	29	.	5953	0.05886	0.00031	0.74639	0.00784	0.09197	0.00083	0.863	1.0	.	562	11	566	5	567	5
C-101018-MK201	392	31	.	6538	0.05850	0.00033	0.74118	0.00637	0.09189	0.00060	0.762	3.4	.	549	11	563	4	567	4
C-01	400	25	.	12808	0.05883	0.00025	0.76926	0.00888	0.09484	0.00102	0.931	4.4	0.2	561	9	579	5	584	6
C-02	374	23	.	6457	0.05887	0.00026	0.75686	0.00875	0.09325	0.00100	0.926	2.3	.	562	9	572	5	575	6
C-101019-MK101	340	19	.	15604	0.05875	0.00024	0.74783	0.00562	0.09233	0.00059	0.843	2.2	.	558	9	567	3	569	3
C-101019-MK102	328	18	.	12593	0.05889	0.00023	0.75020	0.00569	0.09239	0.00060	0.853	1.2	.	563	9	568	3	570	4
C-201010-MK01	474	43	.	11370	0.05857	0.00021	0.74788	0.00446	0.09260	0.00045	0.808	3.7	0.8	551	7	567	3	571	3
C-201010-MK-101	449	34	.	105614	0.05896	0.00024	0.74937	0.00688	0.09218	0.00076	0.894	0.5	.	566	9	568	4	568	4
MK-2010-1-1	466	42	.	9495	0.06526	0.00070	0.91226	0.01660	0.10138	0.00149	0.810	-21.5	-15.9	783	22	658	9	623	9
MK-2010-1-2	492	25	.	2819	0.05447	0.00064	0.42433	0.00739	0.05650	0.00073	0.739	-9.5	.	391	25	359	5	354	4
MK-2010-6-2	678	151	.	14016	0.09011	0.00042	2.92652	0.02775	0.23555	0.00194	0.869	-5.0	-3.1	1428	9	1389	7	1364	10
MK-2010-6-3	35	3	.	685	0.06263	0.00069	0.83312	0.01151	0.09647	0.00080	0.600	-15.4	-8.5	696	23	615	6	594	5
MK-2010-6-4	1396	183	0.62	2261	0.07252	0.00035	1.39875	0.01291	0.13989	0.00110	0.855	-16.7	-14.5	1001	9	888	5	844	6
MK-2010-6-5	124	27	.	7646	0.08861	0.00038	2.79638	0.02625	0.22888	0.00191	0.888	-5.3	-3.5	1396	8	1355	7	1329	10
MK-2010-6-6	54	17	.	4482	0.11342	0.00064	5.03462	0.05883	0.32194	0.00329	0.874	-3.4	-1.5	1855	10	1825	10	1799	16

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 4: U-Pb data for MK-2010-2

Name	U ppm	^{206}Pb ppm	$^{206}Pb_c$* (%)	Ratios $\frac{^{206}Pb}{^{204}Pb}$	Ratios $\frac{^{207}Pb}{^{206}Pb}$	Ratios 1σ	Ratios $\frac{^{207}Pb}{^{235}U}$	Ratios 1σ	Ratios $\frac{^{206}Pb}{^{238}U}$	Ratios 1σ	Rho	Disc.‡ C.	Disc.‡ Min.	Ages (Ma) $\frac{^{207}Pb}{^{206}Pb}$	Ages (Ma) 1σ	Ages (Ma) $\frac{^{207}Pb}{^{235}U}$	Ages (Ma) 1σ	Ages (Ma) $\frac{^{206}Pb}{^{238}U}$	Ages (Ma) 1σ
MK-2010-2-1	248	54	.	12571	0.10059	0.00063	3.89380	0.05732	0.28076	0.00374	0.906	-2.7	-0.3	1635	12	1612	12	1595	19
MK-2010-2-2	18	3	.	414	0.07666	0.00072	2.00481	0.03582	0.18967	0.00289	0.851	0.7	.	1112	18	1117	12	1120	16
MK-2010-2-3	41	7	0.45	1689	0.08383	0.00062	2.55466	0.03744	0.22103	0.00280	0.863	-0.1	.	1289	13	1288	11	1287	15
MK-2010-2-4	53	12	.	4237	0.10719	0.00075	4.16621	0.06597	0.28189	0.00401	0.898	-9.7	-7.3	1752	12	1667	13	1601	20
MK-2010-2-5	30	7	.	1254	0.10865	0.00080	4.39308	0.07623	0.29324	0.00460	0.904	-7.6	-5.0	1777	13	1711	14	1658	23

Table 4 (continued)

Name	U	^{206}Pb	$^{206}Pb_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-2-6	313	22	.	7007	0.05902	0.00035	0.75609	0.00920	0.09292	0.00099	0.876	0.9	.	568	12	572	5	573	6
MK-2010-2-8	45	8	0.34	1371	0.09067	0.00060	3.03952	0.04485	0.24313	0.00321	0.895	-2.8	.	1440	12	1418	11	1403	17
MK-2010-2-9	39	7	.	2021	0.09150	0.00068	3.09945	0.04933	0.24569	0.00345	0.883	-3.1	.	1457	14	1433	12	1416	18
MK-2010-2-10	25	11	0.05	2672	0.20219	0.00190	14.37033	0.36180	0.51546	0.01204	0.928	-7.0	-4.4	2844	15	2774	24	2680	51
MK-2010-2-11	297	12	0.13	2343	0.05382	0.00037	0.41045	0.00520	0.05531	0.00059	0.841	-4.6	.	363	15	349	4	347	4
MK-2010-2-12	192	10	.	2089	0.05705	0.00044	0.56666	0.00824	0.07204	0.00089	0.847	-9.5	-2.1	494	16	456	5	448	5
MK-2010-2-13	224	42	.	11530	0.09135	0.00053	3.07414	0.04474	0.24407	0.00326	0.918	-3.5	-1.1	1454	11	1426	11	1408	17
MK-2010-2-14	186	38	.	8878	0.10015	0.00060	3.73740	0.05591	0.27067	0.00371	0.917	-5.7	-3.4	1627	10	1579	12	1544	19
MK-2010-2-15	449	51	0.10	8925	0.07001	0.00037	1.47897	0.01860	0.15322	0.00175	0.908	-1.1	.	929	10	922	8	919	10
MK-2010-2-16	167	36	.	8187	0.10520	0.00066	4.03619	0.06154	0.27827	0.00387	0.913	-8.9	-6.6	1718	10	1642	12	1583	20
MK-2010-2-17	104	22	.	7727	0.09879	0.00060	3.69616	0.05588	0.27135	0.00376	0.917	-3.8	-1.4	1601	11	1571	12	1548	19
MK-2010-2-18	79	4	.	792	0.05631	0.00050	0.53202	0.00760	0.06852	0.00076	0.780	-8.4	.	465	19	433	5	427	5
MK-2010-2-19	102	8	.	3451	0.06142	0.00045	0.86946	0.01186	0.10266	0.00118	0.841	-3.9	.	654	16	635	6	630	7
MK-2010-2-20	134	24	0.20	6373	0.09098	0.00054	2.96298	0.04321	0.23620	0.00315	0.913	-6.1	-3.6	1446	11	1398	11	1367	16
MK-2010-2-21a	95	20	.	5683	0.10020	0.00061	3.75763	0.05813	0.27200	0.00386	0.918	-5.3	-2.9	1628	11	1584	12	1551	20
MK-2010-2-21b	162	34	.	6472	0.10028	0.00060	3.81337	0.05831	0.27579	0.00388	0.921	-4.1	-1.8	1629	10	1596	12	1570	20
MK-2010-2-22	58	12	.	2835	0.10135	0.00070	3.78453	0.06065	0.27082	0.00391	0.901	-7.1	-4.5	1649	12	1589	13	1545	20
MK-2010-2-23	130	15	.	5881	0.07139	0.00044	1.53466	0.02076	0.15592	0.00188	0.891	-3.8	-0.4	969	12	944	8	934	10
MK-2010-2-24	77	11	0.25	1680	0.07964	0.00053	2.01161	0.02879	0.18319	0.00232	0.886	-9.5	-6.5	1188	13	1119	10	1084	13
MK-2010-2-25	149	22	.	5933	0.07971	0.00048	2.16677	0.03040	0.19716	0.00249	0.901	-2.7	.	1190	12	1170	10	1160	13
MK-2010-2-26	69	8	.	1834	0.06993	0.00049	1.49060	0.02129	0.15460	0.00193	0.873	.	.	926	14	927	9	927	11
MK-2010-2-27	54	11	.	4232	0.10223	0.00069	3.94855	0.06343	0.28013	0.00408	0.907	-4.9	-2.4	1665	12	1624	13	1592	21
MK-2010-2-28	127	4	.	725	0.05436	0.00054	0.35459	0.00529	0.04731	0.00053	0.750	-23.3	-12.8	386	22	308	4	298	3
MK-2010-2-29	48	9	0.30	2372	0.09307	0.00071	3.31996	0.05616	0.25872	0.00391	0.893	-0.5	.	1489	14	1486	13	1483	20
MK-2010-2-30	296	43	0.46	6324	0.09530	0.00058	2.54250	0.04087	0.19350	0.00288	0.926	-28.0	-26.1	1534	11	1284	12	1140	16
MK-2010-2-31	36	4	.	1287	0.07229	0.00142	1.52340	0.03711	0.15284	0.00219	0.589	-8.3	.	994	39	940	15	917	12
MK-2010-2-32	75	13	0.24	2691	0.07997	0.00110	2.02822	0.04161	0.18396	0.00279	0.740	-9.8	-4.3	1196	26	1125	14	1089	15
MK-2010-2-33	251	50	.	8366	0.10139	0.00062	3.69272	0.05721	0.26416	0.00376	0.920	-9.4	-7.2	1650	11	1570	12	1511	19
MK-2010-2-34	69	13	.	2919	0.10118	0.00069	3.54794	0.05816	0.25431	0.00379	0.910	-12.6	-10.2	1646	12	1538	13	1461	20
MK-2010-2-35	121	35	.	7941	0.10446	0.00121	4.22110	0.07057	0.29306	0.00353	0.720	-3.2	.	1705	21	1678	14	1657	18
MK-2010-2-36	306	91	.	25625	0.10892	0.00128	4.47871	0.07529	0.29823	0.00360	0.718	-6.3	-2.8	1781	21	1727	14	1683	18
MK-2010-2-37	65	12	.	1915	0.07726	0.00081	2.04203	0.03040	0.19169	0.00202	0.709	0.2	.	1128	20	1130	10	1130	11
MK-2010-2-38	25	5	.	1608	0.07835	0.00092	2.06916	0.03466	0.19154	0.00229	0.713	-2.5	.	1156	22	1139	11	1130	12
MK-2010-2-39	216	62	.	12962	0.10156	0.00115	4.05575	0.06745	0.28964	0.00353	0.733	-0.9	.	1653	21	1645	14	1640	18
MK-2010-2-40	101	20	.	7423	0.07905	0.00082	2.17518	0.03200	0.19957	0.00207	0.705	.	.	1173	19	1173	10	1173	11
MK-2010-2-41	408	77	.	15208	0.07339	0.00075	1.90540	0.02753	0.18829	0.00191	0.703	9.3	4.5	1025	20	1083	10	1112	10
MK-2010-2-42	1037	291	0.68	2172	0.09936	0.00119	3.68219	0.05726	0.26878	0.00266	0.636	-5.4	-1.8	1612	22	1568	12	1535	14
MK-2010-2-43	154	26	.	5600	0.07350	0.00074	1.74648	0.02412	0.17233	0.00164	0.688	-0.3	.	1028	19	1026	9	1025	9
MK-2010-2-44	352	19	.	5750	0.05267	0.00050	0.41799	0.00526	0.05756	0.00048	0.664	15.1	4.5	314	21	355	4	361	3
MK-2010-2-45	512	27	.	6070	0.05264	0.00049	0.40867	0.00513	0.05631	0.00048	0.678	13.1	2.5	313	20	348	4	353	3
MK-2010-2-46	338	100	.	21405	0.10814	0.00125	4.43160	0.07252	0.29721	0.00346	0.711	-5.8	-2.4	1768	21	1718	14	1677	17
MK-2010-2-47	102	17	.	3136	0.07370	0.00076	1.78443	0.02504	0.17561	0.00168	0.681	1.0	.	1033	20	1040	9	1043	9

Table 4 (continued)

Name	U	^{206}Pb	^{206}Pb$_{c}$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-2-48	333	56	.	12716	0.07274	0.00072	1.75009	0.02405	0.17449	0.00166	0.694	3.2	.	1007	20	1027	9	1037	9
MK-2010-2-49	293	55	.	58088	0.07703	0.00077	2.04765	0.02876	0.19280	0.00190	0.701	1.4	.	1122	19	1132	10	1137	10
MK-2010-2-50	32	15	0.27	39201	0.17961	0.00291	11.61913	0.26913	0.46919	0.00778	0.716	-7.7	-3.9	2649	26	2574	22	2480	34
MK-2010-2-51	37	7	.	1132	0.07892	0.00089	2.13131	0.03304	0.19587	0.00209	0.688	-1.6	.	1170	21	1159	11	1153	11
MK-2010-2-52	172	46	0.13	8013	0.09946	0.00111	3.68970	0.05911	0.26905	0.00310	0.720	-5.4	-1.9	1614	20	1569	13	1536	16
MK-2010-2-53	101	28	0.16	4808	0.09854	0.00110	3.77517	0.06001	0.27785	0.00316	0.714	-1.1	.	1597	20	1587	13	1581	16
MK-2010-2-54	113	58	.	16583	0.19232	0.00328	12.97190	0.31033	0.48919	0.00821	0.702	-8.5	-4.7	2762	28	2678	23	2567	36
MK-2010-2-55	24	5	.	1102	0.07990	0.00092	2.22076	0.03620	0.20157	0.00231	0.705	-1.0	.	1195	22	1188	11	1184	12
MK-2010-2-56	576	152	.	50591	0.09867	0.00110	3.65176	0.05788	0.26841	0.00303	0.712	-4.7	-1.1	1599	19	1561	13	1533	15
MK-2010-2-57	120	36	0.17	4895	0.10736	0.00125	4.47593	0.07448	0.30236	0.00361	0.717	-3.4	.	1755	20	1727	14	1703	18
MK-2010-2-58	41	6	.	2081	0.07128	0.00079	1.57772	0.02349	0.16053	0.00161	0.673	-0.6	.	965	22	961	9	960	9
MK-2010-2-59	242	45	.	7991	0.07651	0.00078	2.01754	0.02899	0.19125	0.00194	0.706	1.9	.	1108	20	1121	10	1128	10
MK-2010-2-60	367	68	.	11756	0.07729	0.00078	2.04197	0.02954	0.19161	0.00197	0.712	0.1	.	1129	20	1130	10	1130	11
MK-2010-2-61	42	10	0.19	2098	0.08989	0.00100	3.04454	0.04821	0.24563	0.00277	0.712	-0.6	.	1423	20	1419	12	1416	14
MK-2010-2-62	250	47	.	8396	0.07708	0.00079	2.04384	0.02980	0.19232	0.00198	0.708	1.0	.	1123	20	1130	10	1134	11
MK-2010-2-63	756	128	.	21180	0.07350	0.00073	1.78525	0.02536	0.17615	0.00178	0.710	1.9	.	1028	19	1040	9	1046	10
MK-2010-2-64	162	25	0.08	5464	0.07135	0.00073	1.60051	0.02282	0.16270	0.00162	0.698	0.5	.	967	20	970	9	972	9
MK-2010-2-65	8	2	.	292	0.08009	0.00113	2.24935	0.05680	0.20369	0.00427	0.831	-0.4	.	1199	27	1197	18	1195	23
MK-2010-2-66	637	135	.	2308	0.09132	0.00192	2.59195	0.08230	0.20585	0.00490	0.749	-18.6	-12.0	1453	39	1298	23	1207	26
MK-2010-2-67	57	9	.	2763	0.07088	0.00077	1.54423	0.02359	0.15802	0.00169	0.700	-0.9	.	954	21	948	9	946	9
MK-2010-2-69	41	8	.	1570	0.07964	0.00091	2.17829	0.03512	0.19836	0.00225	0.704	-2.0	.	1188	22	1174	11	1167	12
MK-2010-2-70	31	6	.	1522	0.07920	0.00092	2.09730	0.03442	0.19206	0.00222	0.705	-4.1	.	1177	23	1148	11	1133	12
MK-2010-2-71	158	24	.	3821	0.07020	0.00072	1.56150	0.02255	0.16132	0.00164	0.703	3.4	.	934	21	955	9	964	9
MK-2010-2-73	383	87	0.10	11166	0.08673	0.00094	2.77186	0.04605	0.23180	0.00292	0.758	-0.9	.	1354	20	1348	12	1344	15
MK-2010-2-74	42	7	.	850	0.07390	0.00083	1.65983	0.02577	0.16290	0.00175	0.691	-6.8	-1.8	1039	22	993	10	973	10
MK-2010-2-75	180	33	.	10115	0.08219	0.00089	2.18368	0.03357	0.19270	0.00210	0.709	-9.9	-5.9	1250	21	1176	11	1136	11
MK-2010-2-76	119	28	0.14	8139	0.09418	0.00108	3.10369	0.05018	0.23900	0.00272	0.704	-9.6	-5.9	1512	21	1434	12	1382	14
MK-2010-2-77	80	14	0.52	2033	0.07504	0.00082	1.89720	0.02919	0.18336	0.00200	0.708	1.6	.	1070	22	1080	10	1085	11
MK-2010-2-78	116	19	.	3814	0.07423	0.00079	1.75502	0.02632	0.17148	0.00181	0.703	-2.8	.	1048	20	1029	10	1020	10
MK-2010-2-79	45	7	.	5443	0.07214	0.00081	1.60606	0.02504	0.16148	0.00175	0.696	-2.7	.	990	22	973	10	965	10
MK-2010-2-80	162	31	0.13	5802	0.08174	0.00089	2.21871	0.03415	0.19687	0.00214	0.706	-7.1	-2.9	1239	20	1187	11	1158	12
MK-2010-2-81	444	23	.	4861	0.05386	0.00055	0.41298	0.00583	0.05561	0.00055	0.694	-4.6	.	365	22	351	4	349	3
MK-2010-2-82	34	9	.	2287	0.10058	0.00122	3.87386	0.06878	0.27935	0.00362	0.731	-3.2	.	1635	22	1608	14	1588	18
MK-2010-2-83	109	17.9	.	3458	0.07317	0.00032	1.69875	0.0217	0.16838	0.00202	0.939	-1.6	.	1019	9	1008	8	1003	11
MK-2010-2-84	124	34.1	.	4538	0.09856	0.00041	3.73468	0.05587	0.27481	0.00395	0.960	-2.3	-0.5	1597	8	1579	12	1565	20
MK-2010-2-85	160	29.4	.	13620	0.07744	0.00031	1.99403	0.02575	0.18675	0.00229	0.950	-2.8	-0.6	1133	8	1113	9	1104	12
MK-2010-2-86	79	15.1	.	3939	0.07907	0.00042	2.11334	0.02867	0.19384	0.00242	0.921	-2.9	-0.3	1174	10	1153	9	1142	13
MK-2010-2-88	100	14.6	0.25	3614	0.07036	0.00054	1.46291	0.02544	0.15079	0.00236	0.899	-3.8	.	939	16	915	10	905	13
MK-2010-2-87	145	13.7	.	3390	0.05974	0.00033	0.80771	0.01013	0.09806	0.00111	0.900	1.6	.	594	12	601	6	603	6
MK-2010-2-95	252	65.6	.	26715	0.09938	0.00043	3.60147	0.06759	0.26283	0.0048	0.973	-7.5	-5.9	1613	8	1550	15	1504	24
MK-2010-2-96	77	11.2	.	2045	0.0721	0.00037	1.48258	0.02314	0.14914	0.0022	0.945	-10	-7.3	989	10	923	9	896	12
MK-2010-A-1	41	8	.	3007	0.07708	0.00039	2.07975	0.01697	0.19569	0.00126	0.787	2.8	0.5	1123	10	1142	6	1152	7

Table 4 (continued)

Name	U	^{206}Pb	$^{206}Pb_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-A-2	104	16	.	4531	0.07099	0.00030	1.53486	0.01075	0.15682	0.00087	0.794	-2.0	.	957	8	944	4	939	5
MK-2010-A-3	138	40	.	15594	0.10744	0.00045	4.19427	0.03847	0.28312	0.00232	0.892	-9.6	-8.2	1757	7	1673	8	1607	12
MK-2010-A-4	23	4	.	1190	0.07415	0.00089	1.63990	0.02420	0.16039	0.00136	0.576	-8.9	-3.8	1046	24	986	9	959	8
MK-2010-A-5	86	15	.	5168	0.07369	0.00037	1.75192	0.01325	0.17244	0.00097	0.744	-0.8	.	1033	10	1028	5	1026	5
MK-2010-A-6	533	29	.	12733	0.05338	0.00019	0.41473	0.00254	0.05634	0.00028	0.807	2.4	.	345	8	352	2	353	2
MK-2010-A-7a	162	44	.	9913	0.10030	0.00037	3.77329	0.02824	0.27286	0.00178	0.872	-5.1	-3.8	1630	7	1587	6	1555	9
MK-2010-A-7b	225	43	.	13315	0.07721	0.00033	2.06285	0.01526	0.19378	0.00118	0.821	1.5	.	1127	9	1137	5	1142	6
MK-2010-A-8	121	31	.	28239	0.09384	0.00035	3.31252	0.02434	0.25603	0.00162	0.859	-2.6	-1.1	1505	7	1484	6	1470	8
MK-2010-A-9	488	137	.	63871	0.10267	0.00036	3.96681	0.02998	0.28022	0.00187	0.885	-5.4	-4.1	1673	6	1627	6	1592	9
MK-2010-A-10	52	8	.	2336	0.07052	0.00035	1.49826	0.01158	0.15409	0.00091	0.762	-2.2	.	943	10	930	5	924	5
MK-2010-A-11	213	33	.	12438	0.07007	0.00025	1.50676	0.00987	0.15596	0.00086	0.840	0.4	.	930	7	933	4	934	5
MK-2010-A-12	240	40	.	11878	0.07260	0.00025	1.68014	0.01120	0.16785	0.00096	0.856	-0.3	.	1003	7	1001	4	1000	5
MK-2010-A-13	122	34	.	12367	0.10034	0.00038	3.87375	0.03162	0.27999	0.00203	0.888	-2.7	-1.3	1630	7	1608	7	1591	10
MK-2010-A-14	71	11	.	22864	0.07056	0.00034	1.52122	0.01191	0.15636	0.00096	0.781	-0.9	.	945	9	939	5	937	5
MK-2010-A-15	176	30	.	20658	0.07350	0.00028	1.73652	0.01211	0.17134	0.00100	0.836	-0.9	.	1028	7	1022	4	1020	6
MK-2010-A-16	66	12	.	7655	0.07868	0.00034	2.08106	0.01577	0.19184	0.00119	0.817	-3.1	-1.1	1164	8	1143	5	1131	6
MK-2010-A-17	335	17	.	5330	0.05369	0.00024	0.39207	0.00269	0.05296	0.00028	0.767	-7.3	-1.6	358	10	336	2	333	2
MK-2010-A-18	110	58	.	23419	0.18699	0.00097	12.94873	0.14200	0.50224	0.00486	0.882	-4.1	-2.7	2716	8	2676	10	2623	21
MK-2010-A-19	979	74	1.80	959	0.05749	0.00099	0.61341	0.01190	0.07739	0.00070	0.464	-6.1	.	510	36	486	7	481	4
MK-2010-A-20	56	29	.	8598	0.18837	0.00100	12.96017	0.14651	0.49899	0.00498	0.883	-5.3	-3.8	2728	8	2677	11	2609	21
MK-2010-A-21	269	80	.	99509	0.10384	0.00038	4.22765	0.03327	0.29527	0.00205	0.882	-1.8	-0.3	1694	7	1679	6	1668	10
MK-2010-A-22	67	6	.	4839	0.05925	0.00036	0.77075	0.00643	0.09434	0.00054	0.690	0.9	.	576	13	580	4	581	3
MK-2010-A-23	196	33	.	12804	0.07445	0.00027	1.76992	0.01284	0.17243	0.00108	0.866	-2.9	-1.0	1054	7	1034	5	1025	6
MK-2010-A-24	109	31	.	28571	0.10182	0.00040	4.01670	0.03344	0.28612	0.00210	0.882	-2.4	-0.9	1658	7	1638	7	1622	11
MK-2010-A-25a	598	31	5.50	951	0.04945	0.00521	0.34900	0.03684	0.05119	0.00037	0.069	92.5	.	169	219	304	28	322	2
MK-2010-A-25b	469	24	2.50	837	0.05313	0.00227	0.37374	0.01617	0.05102	0.00032	0.146	-4.1	.	334	93	322	12	321	2
MK-2010-A-26	184	51	.	15541	0.09916	0.00037	3.79409	0.03030	0.27751	0.00196	0.883	-2.1	-0.6	1608	7	1591	6	1579	10
MK-2010-A-27	112	19	.	9769	0.07961	0.00035	2.22979	0.02126	0.20315	0.00172	0.886	0.5	.	1187	9	1190	7	1192	9
MK-2010-A-28	147	36	.	17401	0.09780	0.00043	3.83433	0.04129	0.28436	0.00279	0.911	2.2	.	1583	8	1600	9	1613	14
MK-2010-A-28b	128	28	.	15245	0.09652	0.00046	3.46886	0.03866	0.26065	0.00263	0.906	-4.7	-2.8	1558	9	1520	9	1493	13
MK-2010-A-29	224	36	.	23582	0.07675	0.00033	2.01044	0.01923	0.18998	0.00162	0.893	0.6	.	1115	8	1119	6	1121	9
MK-2010-A-30	209	34	.	86831	0.07766	0.00033	2.06259	0.01914	0.19263	0.00159	0.888	-0.2	.	1138	8	1136	6	1136	9
MK-2010-A-31	735	161	.	28542	0.09534	0.00042	3.40053	0.03592	0.25867	0.00249	0.911	-3.8	-2.0	1535	8	1505	8	1483	13
MK-2010-A-32	146	30	.	19680	0.09070	0.00039	3.00541	0.03054	0.24032	0.00221	0.907	-4.0	-2.2	1440	8	1409	8	1388	12
MK-2010-A-33	90	11	.	3949	0.07428	0.00036	1.47307	0.01355	0.14384	0.00113	0.853	-18.6	-16.5	1049	9	919	6	866	6
MK-2010-A-34	222	43	.	25770	0.08886	0.00079	2.84210	0.05568	0.23196	0.00404	0.890	-4.5	-0.6	1401	16	1367	15	1345	21
MK-2010-A-35	85	11	.	6223	0.07040	0.00033	1.52420	0.01405	0.15703	0.00125	0.864	.	.	940	9	940	6	940	7
MK-2010-A-36	157	40	.	31873	0.10917	0.00052	4.53663	0.05150	0.30139	0.00311	0.908	-5.6	-3.9	1786	8	1738	9	1698	15
MK-2010-A-37	76	13	.	10106	0.08809	0.00041	2.47940	0.02814	0.20413	0.00212	0.914	-14.8	-13.0	1385	8	1266	8	1197	11

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 5: U-Pb data for MK-2010-3

Name	U	^{206}Pb	$^{206}Pb_c$*	Ratios								Disc.‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-3-1	146	23	.	3912	0.07075	0.00030	1.53892	0.02033	0.15776	0.00197	0.945	-0.7	.	950	9	946	8	944	11
MK-2010-3-2	15	2	.	375	0.07136	0.00080	1.51253	0.02890	0.15372	0.00239	0.812	-5.1	.	968	23	935	12	922	13
MK-2010-3-3	345	90	.	38729	0.09277	0.00035	3.34525	0.05248	0.26154	0.00398	0.970	1.1	.	1483	7	1492	12	1498	20
MK-2010-3-4	269	77	.	10229	0.10222	0.00040	4.03117	0.06372	0.28603	0.00438	0.969	-2.9	-1.4	1665	7	1641	13	1622	22
MK-2010-3-5	97	18	.	3707	0.07665	0.00037	1.99852	0.02817	0.18911	0.00250	0.939	0.4	.	1112	9	1115	10	1117	14
MK-2010-3-6	103	28	.	4233	0.09614	0.00042	3.56714	0.05566	0.26910	0.00403	0.960	-1.0	.	1551	8	1542	12	1536	20
MK-2010-3-7	55	10	.	2192	0.07557	0.00040	1.83733	0.02627	0.17632	0.00234	0.928	-3.7	-0.9	1084	10	1059	9	1047	13
MK-2010-3-9	485	45	.	10969	0.05885	0.00023	0.77365	0.00963	0.09534	0.00113	0.950	4.7	0.7	562	8	582	6	587	7
MK-2010-3-10	152	43	.	24654	0.09904	0.00040	3.85142	0.06111	0.28205	0.00433	0.967	-0.3	.	1606	8	1604	13	1602	22
MK-2010-3-11	110	34	.	10737	0.10717	0.00046	4.53930	0.07555	0.30719	0.00494	0.967	-1.6	.	1752	8	1738	14	1727	24
MK-2010-3-12	71	4	.	572	0.05304	0.00052	0.42289	0.00652	0.05783	0.00069	0.775	10.0	.	330	21	358	5	362	4
MK-2010-3-13	363	105	.	13835	0.10077	0.00039	3.99537	0.06470	0.28756	0.00452	0.970	-0.6	.	1638	7	1633	13	1629	23
MK-2010-3-14	8	1	.	189	0.11746	0.00696	2.74419	0.17658	0.16944	0.00424	0.389	-51.1	-42.1	1918	103	1341	48	1009	23
MK-2010-3-15	105	27	.	68660	0.09314	0.00041	3.32583	0.05260	0.25897	0.00394	0.961	-0.5	.	1491	8	1487	12	1485	20
MK-2010-3-16	109	6	.	730	0.05369	0.00037	0.40261	0.00566	0.05438	0.00067	0.871	-4.8	.	358	15	344	4	341	4
MK-2010-3-17	58	17	.	4932	0.10123	0.00053	4.00215	0.06773	0.28675	0.00461	0.951	-1.5	.	1647	9	1635	14	1625	23
MK-2010-3-18	22	5	.	562	0.08368	0.00054	2.47722	0.04236	0.21471	0.00340	0.925	-2.7	.	1285	13	1265	12	1254	18
MK-2010-3-19	256	40	.	7960	0.07225	0.00029	1.58979	0.02604	0.15958	0.00254	0.970	-4.2	-1.9	993	8	966	10	954	14
MK-2010-3-20	500	121	.	17759	0.09981	0.00039	3.35073	0.05270	0.24349	0.00371	0.968	-14.8	-13.4	1620	7	1493	12	1405	19
MK-2010-3-21	345	35	.	7328	0.06193	0.00026	0.89712	0.01209	0.10507	0.00134	0.949	-4.3	-0.9	672	9	650	6	644	8
MK-2010-3-22	197	19	.	2879	0.06013	0.00028	0.80927	0.01098	0.09761	0.00124	0.938	-1.4	.	608	10	602	6	600	7
MK-2010-3-23	202	53	.	9029	0.09933	0.00041	3.60147	0.05860	0.26297	0.00414	0.967	-7.4	-5.8	1612	8	1550	13	1505	21
MK-2010-3-24	65	14	.	3442	0.08217	0.00039	2.38450	0.03651	0.21046	0.00306	0.951	-1.6	.	1250	9	1238	11	1231	16
MK-2010-3-25	458	134	.	32068	0.10298	0.00041	4.13287	0.06961	0.29106	0.00476	0.972	-2.1	-0.6	1679	7	1661	14	1647	24
MK-2010-3-26	261	15	.	1883	0.05419	0.00028	0.45197	0.00610	0.06050	0.00076	0.926	.	.	379	11	379	4	379	5
MK-2010-3-27	33	6	.	688	0.07664	0.00071	1.83630	0.03231	0.17377	0.00259	0.849	-7.7	-3.3	1112	18	1059	12	1033	14
MK-2010-3-28	280	49	.	14805	0.07331	0.00030	1.77970	0.02595	0.17606	0.00247	0.961	2.4	.	1023	8	1038	9	1045	14
MK-2010-3-29	344	89	.	24589	0.09203	0.00036	3.29003	0.05349	0.25927	0.00409	0.970	1.4	.	1468	7	1479	13	1486	21
MK-2010-3-30	99	16	.	2871	0.07151	0.00035	1.59296	0.02369	0.16156	0.00227	0.945	-0.7	.	972	10	967	9	965	13
MK-2010-3-31	74	14	.	4614	0.07699	0.00038	2.02914	0.03144	0.19114	0.00281	0.947	0.6	.	1121	9	1125	11	1128	15
MK-2010-3-32	834	175	.	47870	0.08841	0.00075	2.61721	0.05362	0.21470	0.00400	0.910	-10.9	-7.4	1391	16	1305	15	1254	21
MK-2010-3-33	2737	154	0.18	10831	0.05425	0.00019	0.43283	0.00586	0.05787	0.00076	0.965	-5.1	-0.4	381	8	365	4	363	5
MK-2010-3-34a	627	27	.	17352	0.05294	0.00025	0.37670	0.00300	0.05161	0.00033	0.813	-0.6	.	326	10	325	2	324	2
MK-2010-3-34b	937	41	.	9085	0.05353	0.00020	0.38849	0.00290	0.05264	0.00034	0.863	-6.0	-0.9	351	8	333	2	331	2
MK-2010-3-35	15	2	.	788	0.08061	0.00067	2.15603	0.03058	0.19399	0.00222	0.807	-6.2	-2.6	1212	16	1167	10	1143	12
MK-2010-3-36	68	19	.	8041	0.11291	0.00057	4.94851	0.05635	0.31787	0.00324	0.895	-4.2	-2.4	1847	9	1811	10	1779	16
MK-2010-3-37	384	88	.	647183	0.09528	0.00039	3.48357	0.03354	0.26518	0.00232	0.908	-1.3	.	1534	7	1524	8	1516	12
MK-2010-3-38	71	9	.	3658	0.07055	0.00040	1.51293	0.01434	0.15553	0.00119	0.807	-1.4	.	944	11	936	6	932	7
MK-2010-3-39	165	24	.	12895	0.07368	0.00030	1.74476	0.01502	0.17175	0.00130	0.879	-1.1	.	1033	8	1025	6	1022	7
MK-2010-3-40a	115	14	.	5470	0.06917	0.00032	1.38262	0.01355	0.14497	0.00125	0.879	-3.7	-0.9	904	9	882	6	873	7

Table 5 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-3-40b	343	45	.	10059	0.07203	0.00030	1.53512	0.01348	0.15456	0.00119	0.880	-6.6	-4.4	987	8	945	5	926	7
MK-2010-3-41	20	3	.	612	0.07085	0.00060	1.55508	0.02037	0.15919	0.00160	0.767	-0.1	.	953	16	953	8	952	9
MK-2010-3-42	315	47	0.31	13236	0.07563	0.00032	1.81152	0.01587	0.17371	0.00134	0.877	-5.3	-3.2	1085	8	1050	6	1033	7
MK-2010-3-43	43	10	.	2348	0.09538	0.00065	3.36353	0.03848	0.25575	0.00235	0.803	-4.9	-2.4	1536	12	1496	9	1468	12
MK-2010-3-44	29	10	.	2674	0.14127	0.00087	7.90931	0.11339	0.40607	0.00526	0.904	-2.4	-0.4	2243	10	2221	13	2197	24
MK-2010-3-45	48	9	.	2767	0.08307	0.00046	2.43536	0.02506	0.21262	0.00184	0.843	-2.4	.	1271	11	1253	7	1243	10
MK-2010-3-47	306	50	.	12509	0.07785	0.00037	2.05027	0.01933	0.19100	0.00156	0.866	-1.6	.	1143	9	1132	6	1127	8
MK-2010-3-48	132	14	.	2800	0.06435	0.00031	1.10374	0.00953	0.12440	0.00089	0.830	0.4	.	753	10	755	5	756	5
MK-2010-3-49	613	27	.	6699	0.05295	0.00023	0.38315	0.00308	0.05248	0.00036	0.844	0.9	.	327	9	329	2	330	2
MK-2010-3-50	118	30	.	9255	0.11042	0.00051	4.49971	0.04751	0.29555	0.00280	0.899	-8.6	-7.0	1806	8	1731	9	1669	14
MK-2010-3-51	334	16	.	4393	0.05366	0.00024	0.41874	0.00342	0.05660	0.00039	0.835	-0.5	.	357	10	355	2	355	2
MK-2010-3-52	239	11	.	1179	0.06081	0.00035	0.45115	0.00399	0.05381	0.00036	0.765	-47.8	-45.5	632	12	378	3	338	2
MK-2010-3-53	543	35	.	5718	0.05837	0.00024	0.62556	0.00505	0.07773	0.00054	0.865	-11.7	-8.3	544	8	493	3	483	3
MK-2010-3-54	131	30	.	7714	0.09334	0.00042	3.37443	0.03446	0.26219	0.00241	0.899	0.5	.	1495	8	1498	8	1501	12
MK-2010-3-55	369	17	.	3763	0.05343	0.00027	0.40086	0.00344	0.05442	0.00038	0.815	-1.6	.	347	11	342	2	342	2
MK-2010-3-56	32	6	.	1689	0.08107	0.00052	2.35467	0.02624	0.21065	0.00193	0.821	0.8	.	1223	12	1229	8	1232	10
MK-2010-3-57	40	6	.	1574	0.07096	0.00041	1.59279	0.01637	0.16281	0.00139	0.829	1.8	.	956	11	967	6	972	8
MK-2010-3-58	755	36	0.16	7712	0.05372	0.00033	0.42434	0.00396	0.05729	0.00040	0.749	.	.	359	14	359	3	359	2
MK-2010-3-59	218	55	.	15682	0.10547	0.00049	4.24902	0.04533	0.29220	0.00280	0.898	-4.6	-2.9	1722	9	1684	9	1652	14
MK-2010-3-60	101	16	.	3467	0.07849	0.00051	2.00365	0.02129	0.18514	0.00155	0.787	-6.0	-3.2	1159	12	1117	7	1095	8
MK-2010-3-61	234	50	.	12183	0.09327	0.00041	3.18189	0.03195	0.24742	0.00224	0.901	-5.1	-3.3	1493	8	1453	8	1425	12
MK-2010-3-62	158	26	.	116962	0.07698	0.00034	2.01095	0.01883	0.18947	0.00157	0.883	-0.2	.	1121	8	1119	6	1118	8
MK-2010-3-63	397	62	.	15629	0.07494	0.00029	1.89718	0.01719	0.18362	0.00151	0.905	2.0	.	1067	7	1080	6	1087	8
MK-2010-3-64	288	18	.	4235	0.05567	0.00027	0.56234	0.00497	0.07326	0.00054	0.838	3.9	.	439	10	453	3	456	3
MK-2010-3-65	336	50	.	14444	0.07352	0.00029	1.76915	0.01596	0.17452	0.00142	0.902	0.9	.	1028	8	1034	6	1037	8
MK-2010-3-66	77	11	.	9929	0.07196	0.00038	1.62181	0.01605	0.16347	0.00137	0.845	-1.0	.	985	11	979	6	976	8
MK-2010-3-67	616	90	.	29550	0.07324	0.00028	1.73806	0.01626	0.17212	0.00147	0.912	0.3	.	1021	7	1023	6	1024	8
MK-2010-3-68	428	57	.	23572	0.07132	0.00030	1.55279	0.01454	0.15790	0.00133	0.896	-2.4	.	967	8	952	6	945	7
MK-2010-3-69	8	1	.	888	0.07386	0.00090	1.81706	0.03790	0.17842	0.00301	0.810	2.2	.	1038	25	1052	14	1058	16
MK-2010-3-70	224	15	.	3975	0.05753	0.00027	0.65090	0.00587	0.08206	0.00063	0.855	-0.7	.	512	10	509	4	508	4
MK-2010-3-71	230	11	.	12615	0.05344	0.00030	0.41409	0.00391	0.05620	0.00043	0.807	1.4	.	348	12	352	3	352	3
MK-2010-3-72	543	82	.	96347	0.07356	0.00029	1.81647	0.01697	0.17911	0.00151	0.905	3.5	1.0	1029	8	1051	6	1062	8
MK-2010-3-73	258	56	4.20	908	0.09218	0.00338	3.00149	0.11446	0.23615	0.00248	0.276	-7.9	.	1471	67	1408	29	1367	13
MK-2010-3-74	229	14	.	3388	0.05564	0.00026	0.54243	0.00490	0.07071	0.00055	0.859	0.6	.	438	10	440	3	440	3
MK-2010-3-75	123	28	.	35927	0.09382	0.00042	3.38786	0.03617	0.26189	0.00254	0.907	-0.4	.	1505	8	1502	8	1499	13
MK-2010-A-38	191	14	.	6457	0.05817	0.00027	0.71482	0.00620	0.08913	0.00065	0.841	2.8	.	536	10	548	4	550	4
MK-2010-A-39	158	53	.	20647	0.14760	0.00083	7.85802	0.10174	0.38613	0.00450	0.900	-10.8	-9.1	2318	9	2215	12	2105	21
MK-2010-A-40	58	9	.	4943	0.07674	0.00037	1.89162	0.01919	0.17877	0.00160	0.880	-5.3	-2.9	1115	9	1078	7	1060	9
MK-2010-A-41	141	11	.	5272	0.05962	0.00029	0.80200	0.00715	0.09756	0.00073	0.840	1.8	.	590	10	598	4	600	4
MK-2010-A-42	156	20	.	8601	0.06925	0.00031	1.45545	0.01323	0.15242	0.00121	0.872	1.0	.	906	9	912	5	915	7
MK-2010-A-43	97	20	.	9101	0.09378	0.00044	3.16501	0.03257	0.24478	0.00224	0.888	-6.8	-5.0	1504	9	1449	8	1412	12
MK-2010-A-44	145	36	.	11633	0.10229	0.00048	4.11180	0.04519	0.29154	0.00290	0.904	-1.1	.	1666	8	1657	9	1649	14

Table 5 (continued)

Name	U	^{206}Pb	$^{206}Pb_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-A-45	212	32	.	28615	0.07336	0.00030	1.83439	0.01761	0.18134	0.00158	0.906	5.3	2.8	1024	8	1058	6	1074	9
MK-2010-A-46	240	50	.	23042	0.09172	0.00040	3.12739	0.03170	0.24730	0.00226	0.901	-2.8	-1.0	1462	8	1439	8	1425	12
MK-2010-A-47	485	23	.	11886	0.05344	0.00023	0.41601	0.00360	0.05646	0.00043	0.871	1.9	.	348	9	353	3	354	3
MK-2010-A-48	117	30	.	9560	0.10701	0.00051	4.37791	0.04828	0.29672	0.00295	0.903	-4.8	-3.1	1749	8	1708	9	1675	15
MK-2010-A-49	260	61	.	25569	0.11229	0.00054	4.29232	0.04696	0.27724	0.00272	0.898	-15.9	-14.4	1837	8	1692	9	1577	14
MK-2010-A-50	26	7	.	4758	0.10980	0.00060	4.68052	0.05530	0.30917	0.00324	0.888	-3.8	-1.8	1796	10	1764	10	1737	16
MK-2010-A-51	15	1	.	556	0.06130	0.00079	0.88341	0.01501	0.10452	0.00115	0.647	-1.4	.	650	27	643	8	641	7
MK-2010-A-53	111	15	0.11	10605	0.07291	0.00036	1.66147	0.01612	0.16528	0.00138	0.863	-2.7	-0.1	1011	10	994	6	986	8
MK-2010-A-54	269	12	0.60	2214	0.05354	0.00066	0.40122	0.00577	0.05435	0.00041	0.523	-3.1	.	352	26	343	4	341	2
MK-2010-A-56	283	17	.	6439	0.05596	0.00040	0.55138	0.00982	0.07146	0.00117	0.915	-1.3	.	451	16	446	6	445	7
MK-2010-A-55	153	29	.	11225	0.09075	0.00042	2.80632	0.02896	0.22429	0.00207	0.896	-10.5	-8.7	1441	8	1357	8	1304	11
MK-2010-A-57	328	27	0.26	15256	0.05994	0.00026	0.80767	0.00735	0.09772	0.00078	0.882	-0.1	.	602	9	601	4	601	5
MK-2010-A-58	389	21	1.40	1086	0.05748	0.00048	0.52068	0.00641	0.06570	0.00059	0.731	-20.2	-13.5	510	18	426	4	410	4
MK-2010-A-59	707	32	.	15353	0.05391	0.00024	0.41178	0.00359	0.05539	0.00042	0.863	-5.6	.	367	10	350	3	348	3
MK-2010-A-60	518	112	.	96368	0.09443	0.00042	3.33879	0.03517	0.25643	0.00245	0.908	-3.3	-1.5	1517	8	1490	8	1472	13
MK-2010-A-61	52	7	.	2157	0.07190	0.00034	1.58480	0.01621	0.15986	0.00144	0.884	-3.0	-0.3	983	10	964	6	956	8
MK-2010-A-62	384	26	0.52	3772	0.05700	0.00028	0.63681	0.00583	0.08102	0.00063	0.850	2.2	.	492	10	500	4	502	4
MK-2010-A-63	114	26	.	8953	0.10082	0.00050	3.70759	0.04108	0.26672	0.00264	0.895	-7.9	-6.1	1639	9	1573	9	1524	13
MK-2010-A-64	424	20	0.17	21696	0.05329	0.00027	0.41637	0.00389	0.05667	0.00044	0.836	4.3	.	341	11	353	3	355	3
MK-2010-A-65	55	6	1.20	2163	0.06518	0.00045	1.18771	0.01323	0.13215	0.00115	0.781	2.7	.	780	14	795	6	800	7
MK-2010-A-66	122	18	.	5469	0.07362	0.00034	1.77111	0.01754	0.17448	0.00153	0.884	0.6	.	1031	9	1035	6	1037	8
MK-2010-A-67	106	20	.	10299	0.08509	0.00040	2.59386	0.02766	0.22108	0.00211	0.895	-2.5	-0.4	1318	9	1299	8	1288	11
MK-2010-A-68	281	51	.	17572	0.11111	0.00109	3.28747	0.09122	0.21458	0.00557	0.936	-34.1	-31.6	1818	17	1478	22	1253	30
MK-2010-A-69	79	15	.	6209	0.08822	0.00043	2.81864	0.02995	0.23172	0.00219	0.890	-3.5	-1.4	1387	9	1361	8	1343	11
MK-2010-A-70	147	35	.	7871	0.10391	0.00050	4.04491	0.04618	0.28231	0.00292	0.907	-6.1	-4.4	1695	9	1643	9	1603	15
MK-2010-A-71	92	7	.	2466	0.05921	0.00034	0.75241	0.00757	0.09217	0.00076	0.818	-1.2	.	575	12	570	4	568	4
MK-2010-A-72	267	65	.	23539	0.10298	0.00049	4.05551	0.04663	0.28563	0.00299	0.911	-4.0	-2.1	1678	9	1645	9	1620	15
MK-2010-A-73	182	41	.	19191	0.09809	0.00047	3.63269	0.04066	0.26861	0.00272	0.904	-3.8	-2.0	1588	9	1557	9	1534	14
MK-2010-A-74	953	131	.	131336	0.07067	0.00029	1.61114	0.01557	0.16535	0.00145	0.905	4.4	1.7	948	8	975	6	986	8
MK-2010-A-75	32	2	.	741	0.05542	0.00060	0.47430	0.00661	0.06207	0.00054	0.625	-9.8	.	429	24	394	5	388	3
MK-2010-A-76	111	9	.	3871	0.06074	0.00036	0.85921	0.00880	0.10259	0.00086	0.820	-0.1	.	630	12	630	5	630	5

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 6: U-Pb data for MK-2010-4

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios								Disc.‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-4-1	193	23	.	7324	0.07183	0.00043	1.55373	0.01789	0.15688	0.00154	0.853	-4.6	-1.4	981	12	952	7	939	9
MK-2010-4-2	189	35	.	7166	0.09275	0.00060	3.00923	0.04464	0.23530	0.00314	0.900	-9.0	-6.5	1483	12	1410	11	1362	16
MK-2010-4-3	94	18	.	3288	0.09335	0.00054	3.22296	0.04158	0.25041	0.00289	0.894	-4.1	-1.7	1495	10	1463	10	1441	15
MK-2010-4-4	768	100	.	16719	0.07408	0.00036	1.72167	0.01936	0.16855	0.00171	0.903	-4.1	-1.5	1044	9	1017	7	1004	9
MK-2010-4-5	96	17	.	3388	0.09071	0.00053	2.87951	0.03636	0.23023	0.00258	0.887	-8.1	-5.7	1440	11	1377	10	1336	14
MK-2010-4-6	154	21	.	8765	0.07657	0.00048	1.89421	0.02290	0.17942	0.00186	0.857	-4.5	-1.5	1110	12	1079	8	1064	10
MK-2010-4-7	64	3	.	669	0.05577	0.00052	0.54372	0.00715	0.07071	0.00066	0.705	-0.7	.	443	20	441	5	440	4
MK-2010-4-8	284	38	.	10874	0.07395	0.00039	1.77930	0.02169	0.17450	0.00192	0.903	-0.3	.	1040	10	1038	8	1037	11
MK-2010-4-9	97	19	.	4037	0.09566	0.00055	3.36135	0.04341	0.25484	0.00294	0.893	-5.6	-3.4	1541	11	1495	10	1463	15
MK-2010-4-10	76	16	.	16073	0.09968	0.00058	3.60921	0.04781	0.26260	0.00312	0.898	-8.0	-5.8	1618	11	1552	11	1503	16
MK-2010-4-11	112	15	.	2707	0.07644	0.00052	1.82322	0.02209	0.17300	0.00174	0.830	-7.6	-4.5	1106	13	1054	8	1029	10
MK-2010-4-12	313	41	.	10762	0.07388	0.00038	1.73767	0.01966	0.17058	0.00172	0.891	-2.4	.	1038	10	1023	7	1015	9
MK-2010-4-13	69	17	.	4875	0.10928	0.00070	4.67300	0.06876	0.31015	0.00411	0.901	-2.9	-0.6	1787	11	1762	12	1741	20
MK-2010-4-14	72	15	.	11523	0.09817	0.00059	3.48864	0.04634	0.25774	0.00306	0.893	-7.8	-5.6	1590	11	1525	10	1478	16
MK-2010-4-15	181	23	0.19	3819	0.07373	0.00040	1.66735	0.01891	0.16401	0.00163	0.875	-5.8	-2.9	1034	11	996	7	979	9
MK-2010-4-16	67	9	.	6741	0.07436	0.00048	1.73017	0.02121	0.16874	0.00176	0.850	-4.7	-1.5	1051	13	1020	8	1005	10
MK-2010-4-17	286	41	0.18	6472	0.07930	0.00057	2.04517	0.02660	0.18704	0.00203	0.836	-6.9	-3.7	1180	14	1131	9	1105	11
MK-2010-4-18	468	62	.	16748	0.07399	0.00038	1.77454	0.02052	0.17395	0.00181	0.898	-0.8	.	1041	10	1036	8	1034	10
MK-2010-4-19	142	15	0.29	34817	0.06857	0.00043	1.34650	0.01593	0.14242	0.00143	0.850	-3.3	.	886	12	866	7	858	8
MK-2010-4-20	34	6	0.58	1292	0.08870	0.00058	2.90951	0.04098	0.23791	0.00297	0.886	-1.7	.	1398	12	1384	11	1376	15
MK-2010-4-21	27	3	.	1455	0.07136	0.00083	1.54665	0.02590	0.15719	0.00188	0.715	-3.0	.	968	23	949	10	941	10
MK-2010-4-22	98	13	.	3159	0.07364	0.00043	1.73928	0.02062	0.17130	0.00177	0.871	-1.3	.	1032	11	1023	8	1019	10
MK-2010-4-23	117	45	.	11199	0.18287	0.00149	11.65782	0.22494	0.46235	0.00808	0.906	-10.3	-8.0	2679	13	2577	18	2450	36
MK-2010-4-24	131	17	.	3556	0.07425	0.00043	1.77650	0.02105	0.17353	0.00179	0.869	-1.7	.	1048	12	1037	8	1032	10
MK-2010-4-25	185	36	.	10139	0.09577	0.00054	3.33573	0.04463	0.25261	0.00307	0.908	-6.6	-4.4	1543	10	1489	10	1452	16
MK-2010-4-26	162	25	0.10	7176	0.08230	0.00053	2.26222	0.03001	0.19935	0.00231	0.875	-7.1	-4.2	1253	12	1201	9	1172	12
MK-2010-4-27	99	13	.	6085	0.07454	0.00045	1.76278	0.02130	0.17152	0.00179	0.864	-3.6	-0.5	1056	12	1032	8	1021	10
MK-2010-4-28	254	40	.	23333	0.08260	0.00049	2.33283	0.02950	0.20484	0.00229	0.882	-5.1	-2.4	1260	11	1222	9	1201	12
MK-2010-4-29	110	21	.	4888	0.09167	0.00060	3.10310	0.04377	0.24551	0.00307	0.887	-3.5	-0.7	1461	12	1433	11	1415	16
MK-2010-4-30	283	38	.	10274	0.07590	0.00042	1.86823	0.02207	0.17852	0.00186	0.884	-3.3	-0.5	1092	11	1070	8	1059	10
MK-2010-4-31	92	18	.	4064	0.09457	0.00068	3.21416	0.04765	0.24651	0.00320	0.876	-7.3	-4.5	1519	13	1461	11	1420	17
MK-2010-4-33	551	113	0.03	25815	0.09977	0.00056	3.62854	0.04939	0.26377	0.00327	0.910	-7.7	-5.5	1620	10	1556	11	1509	17
MK-2010-4-34	122	21	.	5479	0.09010	0.00057	2.84262	0.03756	0.22881	0.00266	0.879	-7.7	-5.2	1428	11	1367	10	1328	14
MK-2010-4-35	133	29	0.48	3703	0.10133	0.00062	3.88774	0.05367	0.27825	0.00345	0.897	-4.5	-2.2	1649	11	1611	11	1583	17
MK-2010-4-36	347	53	.	14504	0.08177	0.00050	2.27694	0.03107	0.20196	0.00246	0.892	-4.8	-1.9	1240	12	1205	10	1186	13
MK-2010-4-37	39	7	.	2168	0.09277	0.00074	3.13971	0.04757	0.24547	0.00317	0.852	-5.1	-2.0	1483	15	1442	12	1415	16
MK-2010-4-38	67	9	.	2628	0.07387	0.00053	1.76968	0.02323	0.17376	0.00191	0.839	-0.5	.	1038	13	1034	9	1033	11
MK-2010-4-39	75	10	.	3047	0.07362	0.00048	1.73085	0.02196	0.17051	0.00185	0.856	-1.7	.	1031	13	1020	8	1015	10
MK-2010-4-40	140	29	.	9519	0.09874	0.00059	3.69208	0.05111	0.27119	0.00338	0.901	-3.8	-1.4	1600	11	1570	11	1547	17
MK-2010-4-41	20	2	.	797	0.07061	0.00087	1.52782	0.02913	0.15693	0.00229	0.764	-0.7	.	946	24	942	12	940	13

Table 6 (continued)

Name	U	^{206}Pb	$^{206}Pb_c*$	Ratios								Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-4-42	309	42	.	7714	0.08793	0.00062	1.88509	0.02394	0.15549	0.00164	0.830	-34.9	-33.0	1381	13	1076	8	932	9
MK-2010-4-43	79	20	.	2977	0.10162	0.00068	3.86257	0.04238	0.27568	0.00239	0.789	-5.7	-3.5	1654	12	1606	9	1570	12
MK-2010-4-44	303	47	.	9921	0.07391	0.00044	1.79302	0.01669	0.17594	0.00127	0.772	0.6	.	1039	11	1043	6	1045	7
MK-2010-4-45	100	25	.	4501	0.09937	0.00066	3.86298	0.04268	0.28193	0.00249	0.798	-0.8	.	1612	12	1606	9	1601	13
MK-2010-4-46	125	24	.	4262	0.08631	0.00058	2.56317	0.02731	0.21539	0.00177	0.772	-7.2	-4.6	1345	12	1290	8	1257	9
MK-2010-4-47	182	28	.	7255	0.07368	0.00044	1.77958	0.01673	0.17518	0.00126	0.768	0.8	.	1033	11	1038	6	1041	7
MK-2010-4-48	85	13	.	4012	0.07584	0.00049	1.78816	0.01752	0.17100	0.00126	0.751	-7.3	-4.5	1091	13	1041	6	1018	7
MK-2010-4-49	322	84	.	27227	0.10078	0.00065	4.03881	0.04417	0.29065	0.00256	0.806	0.4	.	1639	11	1642	9	1645	13
MK-2010-4-50	154	40	.	9648	0.10310	0.00069	4.14580	0.04606	0.29165	0.00258	0.796	-2.1	.	1681	12	1663	9	1650	13
MK-2010-4-51	567	106	.	36383	0.08808	0.00067	2.62317	0.03112	0.21600	0.00198	0.771	-9.8	-7.1	1384	14	1307	9	1261	10
MK-2010-4-52	266	52	.	11631	0.09171	0.00057	2.77667	0.02830	0.21958	0.00177	0.792	-13.7	-11.6	1461	11	1349	8	1280	9
MK-2010-4-53	192	42	.	6055	0.09178	0.00057	3.14191	0.03244	0.24828	0.00204	0.798	-2.5	-0.1	1463	12	1443	8	1430	11
MK-2010-4-54	29	4	.	1356	0.07094	0.00063	1.54334	0.01940	0.15779	0.00140	0.708	-1.3	.	956	18	948	8	944	8
MK-2010-4-55	165	23	.	4367	0.07345	0.00045	1.62529	0.01528	0.16048	0.00115	0.759	-7.0	-4.2	1026	12	980	6	959	6
MK-2010-4-56	106	14	.	3197	0.06997	0.00045	1.49874	0.01434	0.15536	0.00111	0.746	0.4	.	927	12	930	6	931	6
MK-2010-4-57	360	104	.	81377	0.11103	0.00075	4.92270	0.05727	0.32156	0.00304	0.813	-1.2	.	1816	12	1806	10	1797	15
MK-2010-4-58	92	14	.	6650	0.07362	0.00046	1.78651	0.01763	0.17600	0.00134	0.769	1.5	.	1031	12	1041	6	1045	7
MK-2010-4-59	225	52	.	12884	0.09364	0.00060	3.36529	0.03553	0.26065	0.00219	0.796	-0.6	.	1501	12	1496	8	1493	11
MK-2010-4-60	245	17	.	1766	0.06449	0.00045	0.69952	0.00675	0.07867	0.00052	0.690	-36.9	-34.1	758	14	539	4	488	3
MK-2010-4-61	397	79	.	37936	0.08662	0.00053	2.68432	0.02693	0.22476	0.00179	0.794	-3.7	-1.2	1352	11	1324	7	1307	9
MK-2010-4-62	64	14	.	3602	0.09300	0.00064	3.22319	0.03647	0.25135	0.00225	0.792	-3.2	-0.6	1488	13	1463	9	1445	12
MK-2010-4-63	123	25	.	6943	0.09115	0.00060	2.92355	0.03056	0.23263	0.00189	0.778	-7.7	-5.4	1450	12	1388	8	1348	10
MK-2010-4-64	450	79	.	32955	0.08967	0.00066	2.47970	0.03588	0.20057	0.00249	0.859	-18.5	-15.9	1418	14	1266	10	1178	13
MK-2010-4-66	99	24	.	4788	0.09901	0.00067	3.67482	0.04041	0.26918	0.00233	0.787	-4.8	-2.5	1606	13	1566	9	1537	12
MK-2010-4-67	68	9	.	5158	0.07000	0.00052	1.49617	0.01635	0.15502	0.00125	0.739	0.1	.	928	14	929	7	929	7
MK-2010-4-68	47	6	.	1095	0.07666	0.00091	1.50361	0.02209	0.14226	0.00122	0.586	-24.5	-20.5	1112	22	932	9	857	7
MK-2010-4-69	267	68	.	12436	0.10099	0.00066	3.99709	0.04555	0.28707	0.00267	0.816	-1.1	.	1642	12	1634	9	1627	13
MK-2010-4-70	179	47	.	6773	0.10173	0.00068	4.10596	0.04648	0.29272	0.00267	0.805	-0.1	.	1656	12	1655	9	1655	13
MK-2010-4-71	131	23	.	9784	0.07929	0.00087	2.03309	0.04153	0.18596	0.00320	0.844	-7.4	-2.4	1179	21	1127	14	1099	17
MK-2010-4-72	32	5	.	1125	0.07385	0.00065	1.72932	0.02228	0.16984	0.00159	0.728	-2.7	.	1037	17	1019	8	1011	9
MK-2010-A-77	91	13	.	3038	0.07653	0.00047	1.82820	0.01994	0.17325	0.00157	0.829	-7.7	-4.9	1109	12	1056	7	1030	9
MK-2010-A-78	454	119	.	105693	0.11004	0.00055	4.67988	0.05587	0.30844	0.00334	0.908	-4.2	-2.4	1800	9	1764	10	1733	16
MK-2010-A-79	320	45	.	6314	0.07463	0.00032	1.73188	0.01742	0.16832	0.00153	0.902	-5.7	-3.4	1058	8	1020	6	1003	8
MK-2010-A-80	99	21	.	6548	0.09325	0.00047	3.24722	0.03656	0.25257	0.00255	0.896	-3.1	-1.0	1493	9	1469	9	1452	13
MK-2010-A-81	83	19	.	11357	0.09876	0.00050	3.74299	0.04367	0.27487	0.00289	0.900	-2.5	-0.5	1601	9	1581	9	1565	15
MK-2010-A-82	194	28	.	11924	0.07408	0.00034	1.75296	0.01804	0.17162	0.00158	0.894	-2.3	.	1044	9	1028	7	1021	9
MK-2010-A-83	141	18	0.23	5068	0.07115	0.00040	1.48594	0.01591	0.15147	0.00139	0.855	-5.9	-2.9	962	11	925	6	909	8
MK-2010-A-84	380	84	.	24056	0.09815	0.00050	3.56607	0.04400	0.26352	0.00296	0.910	-5.7	-3.7	1589	9	1542	10	1508	15
MK-2010-A-85	109	18	.	3515	0.07344	0.00036	1.75460	0.01585	0.17329	0.00132	0.843	0.4	.	1026	10	1029	6	1030	7
MK-2010-A-86a	44	11	.	2710	0.09781	0.00053	3.62920	0.04003	0.26911	0.00258	0.869	-3.3	-1.2	1583	10	1556	9	1536	13
MK-2010-A-86b	159	46	.	13065	0.11695	0.00057	4.88107	0.05575	0.30269	0.00312	0.904	-12.2	-10.7	1910	9	1799	10	1705	15
MK-2010-A-87	551	93	.	21431	0.07396	0.00029	1.82838	0.01607	0.17929	0.00141	0.897	2.4	0.1	1040	7	1056	6	1063	8

Table 6 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-A-88	272	45	0.17	17578	0.07354	0.00030	1.77099	0.01573	0.17466	0.00138	0.888	0.9	.	1029	8	1035	6	1038	8
MK-2010-A-89	83	13	0.09	2603	0.07297	0.00044	1.71246	0.01858	0.17021	0.00153	0.830	.	.	1013	12	1013	7	1013	8
MK-2010-A-90	481	82	.	22251	0.07502	0.00034	1.86956	0.01829	0.18075	0.00157	0.889	0.2	.	1069	9	1070	6	1071	9
MK-2010-A-91	588	54	0.82	1654	0.05989	0.00034	0.80672	0.00809	0.09770	0.00081	0.827	0.3	.	599	12	601	5	601	5
MK-2010-A-92	143	11	.	3347	0.05723	0.00034	0.65236	0.00645	0.08267	0.00065	0.797	2.4	.	501	13	510	4	512	4
MK-2010-A-94	51	8	.	1445	0.07415	0.00045	1.77547	0.02009	0.17365	0.00166	0.844	-1.4	.	1046	12	1037	7	1032	9
MK-2010-A-95	45	11	0.26	2425	0.08950	0.00049	3.03418	0.03876	0.24588	0.00284	0.905	0.2	.	1415	10	1416	10	1417	15
MK-2010-A-96	621	104	.	19268	0.07398	0.00029	1.82683	0.01693	0.17909	0.00150	0.904	2.2	.	1041	8	1055	6	1062	8
MK-2010-A-97	211	33	.	6832	0.07440	0.00032	1.73329	0.01607	0.16896	0.00139	0.886	-4.7	-2.5	1052	8	1021	6	1006	8
MK-2010-98a	322	46	0.16	9694	0.07307	0.00034	1.69393	0.01897	0.16814	0.00171	0.910	-1.5	.	1016	9	1006	7	1002	9
MK-2010-98b	406	59	0.02	68515	0.07403	0.00033	1.73338	0.01959	0.16981	0.00176	0.918	-3.2	-0.8	1042	8	1021	7	1011	10
MK-2010-A-99a	479	71	.	24673	0.07405	0.00033	1.77178	0.01977	0.17352	0.00178	0.918	-1.2	.	1043	9	1035	7	1031	10
MK-2010-A-99b	412	60	.	16085	0.07341	0.00033	1.72939	0.01940	0.17087	0.00176	0.918	-0.9	.	1025	8	1020	7	1017	10
MK-2010-A-100	98	21	.	5315	0.09125	0.00048	3.08234	0.04113	0.24499	0.00300	0.917	-3.0	-0.7	1452	10	1428	10	1413	16
MK-2010-A-101	462	90	.	20685	0.09161	0.00043	2.89631	0.02844	0.22930	0.00198	0.881	-9.7	-7.9	1459	8	1381	7	1331	10
MK-2010-A-102	78	10	.	3209	0.07102	0.00042	1.46891	0.01715	0.15002	0.00151	0.863	-6.4	-3.2	958	11	918	7	901	8
MK-2010-A-103	687	103	.	8165	0.07510	0.00033	1.81458	0.02067	0.17524	0.00184	0.923	-3.1	-0.7	1071	9	1051	7	1041	10
MK-2010-A-104	52	7	.	2704	0.07138	0.00044	1.56606	0.01884	0.15913	0.00165	0.861	-1.8	.	968	12	957	7	952	9
MK-2010-A-105	39	5	.	1937	0.07023	0.00045	1.45675	0.01785	0.15044	0.00157	0.852	-3.6	.	935	13	913	7	903	9
MK-2010-A-106	416	28	.	4927	0.05699	0.00026	0.63981	0.00653	0.08142	0.00074	0.896	2.8	.	491	9	502	4	505	4
MK-2010-A-107	566	85	.	22369	0.07416	0.00033	1.80029	0.02035	0.17607	0.00183	0.919	.	.	1046	9	1046	7	1045	10
MK-2010-A-108	824	137	1.50	1025	0.08346	0.00064	2.28418	0.04484	0.19851	0.00359	0.921	-9.6	-6.3	1280	14	1207	14	1167	19
MK-2010-A-109	160	23	.	6222	0.07336	0.00036	1.71182	0.01825	0.16923	0.00160	0.889	-1.7	.	1024	10	1013	7	1008	9
MK-2010-A-110	117	17	.	3237	0.07415	0.00038	1.73692	0.01881	0.16990	0.00162	0.879	-3.5	-0.8	1045	10	1022	7	1012	9
MK-2010-A-111	94	20	.	5414	0.09197	0.00047	3.12005	0.03811	0.24604	0.00273	0.908	-3.7	-1.6	1467	9	1438	9	1418	14
MK-2010-A-112	48	8	.	4641	0.07986	0.00047	2.12199	0.02603	0.19270	0.00207	0.877	-5.3	-2.5	1194	11	1156	8	1136	11
MK-2010-A-114	625	94	0.29	4965	0.07421	0.00036	1.81079	0.02035	0.17696	0.00179	0.902	0.3	.	1047	9	1049	7	1050	10

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 7: U-Pb data for MK-2010-5

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc.‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-5-1	205	52	.	12812	0.11303	0.00079	4.48764	0.05229	0.28794	0.00268	0.797	-13.3	-11.2	1849	12	1729	10	1631	13
MK-2010-5-2	272	23	0.11	3916	0.06143	0.00040	0.82045	0.00787	0.09687	0.00068	0.735	-9.3	-4.9	654	13	608	4	596	4

Table 7 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-5-3	498	74	.	32829	0.07379	0.00043	1.75059	0.01672	0.17206	0.00130	0.788	-1.3	.	1036	11	1027	6	1023	7
MK-2010-5-4	825	51	.	11284	0.05633	0.00032	0.55717	0.00497	0.07173	0.00050	0.778	-4.2	.	465	12	450	3	447	3
MK-2010-5-5	732	103	.	23968	0.07085	0.00041	1.58615	0.01494	0.16238	0.00121	0.792	1.9	.	953	11	965	6	970	7
MK-2010-5-6	1553	228	.	17759	0.07134	0.00041	1.68483	0.01898	0.17130	0.00166	0.858	5.8	2.4	967	11	1003	7	1019	9
MK-2010-5-7	353	54	.	24608	0.07369	0.00043	1.77408	0.01705	0.17461	0.00133	0.790	0.5	.	1033	12	1036	6	1037	7
MK-2010-5-8	157	23	.	480026	0.07360	0.00047	1.71507	0.01733	0.16901	0.00132	0.774	-2.5	.	1030	13	1014	6	1007	7
MK-2010-5-9	29	4	.	1089	0.07484	0.00065	1.67430	0.02230	0.16225	0.00164	0.759	-9.6	-5.8	1064	17	999	8	969	9
MK-2010-5-11	45	7	.	1403	0.07394	0.00054	1.79600	0.02001	0.17617	0.00147	0.751	0.6	.	1040	15	1044	7	1046	8
MK-2010-5-12	696	122	.	18753	0.08020	0.00050	2.21882	0.02389	0.20066	0.00176	0.813	-2.1	.	1202	12	1187	8	1179	9
MK-2010-5-13	37	9	.	2417	0.09914	0.00073	3.89803	0.04924	0.28516	0.00293	0.812	0.7	.	1608	13	1613	10	1617	15
MK-2010-5-14	78	18	.	5149	0.09314	0.00066	3.30073	0.03784	0.25703	0.00232	0.786	-1.2	.	1491	13	1481	9	1475	12
MK-2010-5-15	148	30	.	7129	0.08786	0.00061	2.82447	0.03227	0.23316	0.00212	0.797	-2.3	.	1379	13	1362	9	1351	11
MK-2010-5-16	198	28	.	7078	0.07000	0.00045	1.55383	0.01764	0.16100	0.00151	0.826	3.9	0.3	928	13	952	7	962	8
MK-2010-5-17	187	37	.	7517	0.08524	0.00055	2.66598	0.02856	0.22683	0.00194	0.798	-0.3	.	1321	12	1319	8	1318	10
MK-2010-5-18	243	38	.	7749	0.07454	0.00047	1.84937	0.01908	0.17995	0.00148	0.794	1.1	.	1056	13	1063	7	1067	8
MK-2010-5-19	167	47	.	7060	0.10984	0.00078	4.78250	0.05804	0.31580	0.00310	0.810	-1.8	.	1797	12	1782	10	1769	15
MK-2010-5-21	92	15	.	7331	0.07951	0.00062	2.09965	0.02413	0.19152	0.00162	0.736	-5.1	-1.9	1185	15	1149	8	1130	9
MK-2010-5-22	53	7	.	1962	0.07063	0.00057	1.50685	0.01764	0.15473	0.00131	0.722	-2.2	.	947	16	933	7	927	7
MK-2010-5-24	436	65	.	14052	0.07393	0.00045	1.74986	0.01765	0.17167	0.00138	0.795	-1.9	.	1039	12	1027	7	1021	8
MK-2010-5-25	143	42	.	6034	0.11566	0.00089	5.24043	0.06646	0.32860	0.00332	0.797	-3.6	-1.1	1890	13	1859	11	1832	16
MK-2010-5-26	20	3	.	1194	0.06991	0.00070	1.53942	0.02415	0.15970	0.00192	0.768	3.4	.	926	19	946	10	955	11
MK-2010-5-27	75	11	.	2900	0.07392	0.00052	1.77186	0.01963	0.17386	0.00149	0.772	-0.6	.	1039	14	1035	7	1033	8
MK-2010-5-29	44	7	0.39	3039	0.09309	0.00058	3.07136	0.04729	0.23929	0.00337	0.915	-8.0	-5.5	1490	11	1426	12	1383	18
MK-2010-5-30	198	22	.	13749	0.07133	0.00033	1.60668	0.02038	0.16338	0.00193	0.931	1.0	.	967	9	973	8	976	11
MK-2010-5-31	84	10	.	5376	0.07456	0.00036	1.82037	0.02397	0.17708	0.00217	0.931	-0.6	.	1057	9	1053	9	1051	12
MK-2010-5-32	196	27	.	10245	0.08022	0.00037	2.21438	0.02962	0.20021	0.00251	0.939	-2.4	.	1202	8	1186	9	1176	14
MK-2010-5-33	94	20	.	9307	0.10953	0.00062	4.70035	0.07925	0.31125	0.00494	0.942	-2.9	-0.7	1792	10	1767	14	1747	24
MK-2010-5-34	345	40	0.40	3680	0.07428	0.00033	1.78070	0.02282	0.17386	0.00209	0.938	-1.6	.	1049	9	1038	8	1033	11
MK-2010-5-35	197	23	.	10582	0.07503	0.00039	1.76785	0.02355	0.17089	0.00210	0.922	-5.3	-2.6	1069	10	1034	9	1017	12
MK-2010-5-36	87	10	.	5697	0.07385	0.00040	1.75157	0.02368	0.17202	0.00213	0.917	-1.5	.	1037	11	1028	9	1023	12
MK-2010-5-37	25	4	.	1522	0.08347	0.00053	2.48885	0.03883	0.21626	0.00309	0.914	-1.6	.	1280	12	1269	11	1262	16
MK-2010-5-38	159	22	.	9784	0.08112	0.00037	2.33012	0.03166	0.20832	0.00267	0.942	-0.4	.	1224	9	1222	10	1220	14
MK-2010-5-39	218	40	.	10393	0.09857	0.00053	3.59898	0.05581	0.26482	0.00386	0.939	-5.8	-3.7	1597	10	1549	12	1514	20
MK-2010-5-40	512	24	.	7990	0.05651	0.00028	0.56383	0.00681	0.07237	0.00080	0.915	-4.8	.	472	11	454	4	450	5
MK-2010-5-41	465	72	.	50829	0.09230	0.00046	2.91988	0.04250	0.22943	0.00314	0.941	-10.7	-8.7	1474	9	1387	11	1332	16
MK-2010-5-42	321	38	.	17907	0.07425	0.00035	1.81905	0.02443	0.17769	0.00224	0.938	0.6	.	1048	9	1052	9	1054	12
MK-2010-5-43	253	49	.	21148	0.10197	0.00053	3.97986	0.06378	0.28307	0.00429	0.945	-3.6	-1.6	1660	9	1630	13	1607	22
MK-2010-5-44	162	18	.	3715	0.07265	0.00036	1.66059	0.02472	0.16579	0.00233	0.942	-1.6	.	1004	10	994	9	989	13
MK-2010-5-45	24	2	.	2061	0.07000	0.00058	1.44037	0.02212	0.14923	0.00193	0.842	-3.7	.	928	17	906	9	897	11
MK-2010-5-47	227	26	.	12237	0.07352	0.00035	1.76161	0.02383	0.17378	0.00220	0.935	0.5	.	1028	9	1031	9	1033	12
MK-2010-5-48	98	17	.	7658	0.09889	0.00054	3.54515	0.05563	0.26001	0.00383	0.938	-7.9	-5.8	1603	10	1537	12	1490	20
MK-2010-5-49	112	12	.	5334	0.07123	0.00035	1.59960	0.02195	0.16287	0.00209	0.934	1.0	.	964	10	970	9	973	12

Table 7 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-5-50	66	8	.	6814	0.07360	0.00043	1.74811	0.02463	0.17226	0.00221	0.910	-0.6	.	1030	11	1026	9	1025	12
MK-2010-5-51	413	19	.	22236	0.05572	0.00029	0.53877	0.00673	0.07013	0.00080	0.911	-1.0	.	441	11	438	4	437	5
MK-2010-5-52	197	10	0.45	2634	0.05732	0.00035	0.60818	0.00774	0.07695	0.00086	0.881	-5.4	.	504	13	482	5	478	5
MK-2010-5-53	253	29	.	11933	0.07358	0.00036	1.75188	0.02425	0.17267	0.00224	0.937	-0.3	.	1030	10	1028	9	1027	12
MK-2010-5-54	22	5	.	3366	0.11164	0.00076	4.67267	0.08327	0.30356	0.00500	0.924	-7.3	-4.9	1826	12	1762	15	1709	25
MK-2010-5-55	145	11	0.31	3773	0.06417	0.00032	1.04143	0.01326	0.11771	0.00138	0.920	-4.2	-0.6	747	10	725	7	717	8
MK-2010-5-56	104	13	.	6218	0.07842	0.00042	2.06297	0.02969	0.19079	0.00255	0.927	-3.0	-0.3	1158	11	1137	10	1126	14
MK-2010-5-57	81	15	.	9001	0.10040	0.00057	3.83039	0.06300	0.27670	0.00427	0.939	-3.9	-1.7	1632	10	1599	13	1575	22
MK-2010-5-58	187	33	.	15498	0.09376	0.00050	3.30881	0.05317	0.25595	0.00388	0.944	-2.5	-0.3	1503	10	1483	13	1469	20
MK-2010-5-59	472	77	.	29394	0.09393	0.00047	3.13310	0.04687	0.24192	0.00341	0.941	-8.1	-6.1	1507	10	1441	12	1397	18
MK-2010-5-60	180	29	.	10280	0.08860	0.00046	2.89993	0.04478	0.23740	0.00345	0.941	-1.8	.	1395	9	1382	12	1373	18
MK-2010-5-61	224	44	.	19033	0.10163	0.00056	4.00912	0.06705	0.28611	0.00452	0.945	-2.2	.	1654	10	1636	14	1622	23
MK-2010-A-115	979	149	0.35	5267	0.07490	0.00056	1.84488	0.02330	0.17864	0.00182	0.808	-0.6	.	1066	14	1062	8	1060	10
MK-2010-A-116	174	45	.	13582	0.10911	0.00058	4.47364	0.06118	0.29738	0.00374	0.921	-6.8	-4.8	1785	10	1726	11	1678	19
MK-2010-A-117	123	16	.	5608	0.06952	0.00036	1.46504	0.01684	0.15284	0.00157	0.891	0.3	.	914	11	916	7	917	9
MK-2010-A-118	166	41	.	16019	0.10119	0.00052	3.96176	0.05500	0.28395	0.00367	0.930	-2.4	-0.4	1646	9	1626	11	1611	18
MK-2010-A-119	300	19	0.35	3159	0.05633	0.00037	0.57764	0.00853	0.07437	0.00098	0.893	-0.7	.	466	14	463	5	462	6
MK-2010-A-120	266	41	.	10798	0.07658	0.00035	1.91104	0.02306	0.18099	0.00202	0.925	-3.7	-1.3	1110	9	1085	8	1072	11
MK-2010-A-121	89	13	.	2631	0.07372	0.00042	1.74964	0.02136	0.17214	0.00186	0.885	-1.0	.	1034	11	1027	8	1024	10
MK-2010-A-122	99	15	.	9752	0.07382	0.00037	1.76493	0.02154	0.17340	0.00193	0.913	-0.6	.	1037	10	1033	8	1031	11
MK-2010-A-123	135	20	.	4347	0.07473	0.00070	1.79368	0.02757	0.17408	0.00212	0.792	-2.7	.	1061	18	1043	10	1035	12
MK-2010-A-125	284	76	.	25076	0.10956	0.00058	4.61061	0.07664	0.30520	0.00481	0.948	-4.8	-2.8	1792	9	1751	14	1717	24
MK-2010-A-126	514	122	.	6352	0.10227	0.00052	3.84998	0.05903	0.27303	0.00395	0.944	-7.4	-5.5	1666	9	1603	12	1556	20
MK-2010-A-127	140	29	.	10166	0.09033	0.00046	2.99789	0.04167	0.24071	0.00312	0.931	-3.3	-1.1	1432	9	1407	11	1390	16
MK-2010-A-128	214	30	3.00	484	0.07421	0.00059	1.65695	0.02465	0.16193	0.00204	0.848	-8.2	-4.3	1047	15	992	9	967	11
MK-2010-A-129	119	25	1.10	1395	0.09932	0.00057	3.27357	0.04309	0.23905	0.00283	0.901	-15.8	-13.9	1611	10	1475	10	1382	15
MK-2010-A-130	77	10	.	6207	0.07083	0.00043	1.52489	0.01963	0.15614	0.00177	0.882	-1.9	.	952	12	940	8	935	10
MK-2010-A-131	1047	140	1.60	1022	0.07339	0.00069	1.57267	0.02236	0.15543	0.00165	0.747	-9.8	-5.5	1025	18	959	9	931	9
MK-2010-A-132	847	50	.	18232	0.05642	0.00026	0.55916	0.00646	0.07187	0.00076	0.915	-4.8	.	469	10	451	4	447	5
MK-2010-A-133	653	43	0.66	1957	0.05613	0.00030	0.61560	0.00726	0.07955	0.00084	0.895	8.2	2.3	457	11	487	5	493	5
MK-2010-A-134	339	81	.	20144	0.10515	0.00056	4.00952	0.05774	0.27655	0.00370	0.930	-9.4	-7.5	1717	10	1636	12	1574	19
MK-2010-A-135	199	29	.	11632	0.07401	0.00037	1.76991	0.02165	0.17344	0.00194	0.913	-1.1	.	1042	9	1034	8	1031	11
MK-2010-A-136	328	48	0.75	2096	0.07377	0.00048	1.76079	0.02285	0.17310	0.00194	0.862	-0.6	.	1035	13	1031	8	1029	11
MK-2010-A-137	424	63	.	15044	0.07424	0.00035	1.79969	0.02164	0.17581	0.00195	0.920	-0.4	.	1048	9	1045	8	1044	11
MK-2010-A-138	99	14	.	8510	0.07401	0.00044	1.76472	0.02339	0.17293	0.00205	0.896	-1.4	.	1042	11	1033	9	1028	11
MK-2010-A-139	175	29	.	12841	0.07708	0.00040	2.04555	0.02605	0.19246	0.00224	0.915	1.1	.	1123	10	1131	9	1135	12
MK-2010-A-140	206	31	.	7235	0.07396	0.00036	1.80332	0.02323	0.17683	0.00211	0.928	1.0	.	1040	9	1047	8	1050	12
MK-2010-A-141	208	31	.	7774	0.07392	0.00037	1.78999	0.02254	0.17563	0.00203	0.919	0.4	.	1039	10	1042	8	1043	11
MK-2010-A-142	286	63	.	25893	0.09460	0.00049	3.31691	0.04637	0.25429	0.00330	0.929	-4.4	-2.2	1520	10	1485	11	1461	17
MK-2010-A-143	455	68	.	10470	0.07495	0.00036	1.82556	0.02306	0.17664	0.00206	0.925	-1.9	.	1067	9	1055	8	1049	11
MK-2010-A-145	190	28	0.80	1571	0.07430	0.00040	1.75088	0.02253	0.17091	0.00200	0.908	-3.4	-0.4	1050	11	1027	8	1017	11
MK-2010-A-144	21	4	.	1329	0.09154	0.00066	2.81783	0.04563	0.22325	0.00324	0.896	-12.0	-9.3	1458	13	1360	12	1299	17

Table 7 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios								Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-A-146	244	56	.	30748	0.09811	0.00052	3.60961	0.05271	0.26684	0.00363	0.932	-4.5	-2.4	1588	10	1552	12	1525	18
MK-2010-A-147	1224	162	.	58443	0.07021	0.00032	1.53029	0.01861	0.15807	0.00178	0.926	1.3	.	935	9	943	7	946	10
MK-2010-A-148	85	11	.	4771	0.07297	0.00040	1.59010	0.02026	0.15804	0.00182	0.902	-7.1	-4.2	1013	11	966	8	946	10
MK-2010-A-149	174	25	.	6338	0.07356	0.00037	1.74424	0.02174	0.17198	0.00196	0.916	-0.7	.	1029	10	1025	8	1023	11
MK-2010-A-150a	310	88	.	14373	0.11025	0.00061	4.88759	0.07852	0.32154	0.00485	0.938	-0.4	.	1803	10	1800	14	1797	24
MK-2010-A-150b	530	145	.	27326	0.11003	0.00061	4.77497	0.07340	0.31475	0.00452	0.933	-2.3	-0.2	1800	10	1781	13	1764	22
MK-2010-A-151	105	22	.	6023	0.09298	0.00051	3.19467	0.04513	0.24919	0.00324	0.920	-4.0	-1.7	1487	10	1456	11	1434	17
MK-2010-A-152	668	121	0.17	7711	0.08301	0.00041	2.44108	0.03221	0.21329	0.00261	0.926	-2.0	.	1269	10	1255	10	1246	14
MK-2010-A-153	98	13	.	2794	0.07120	0.00043	1.54844	0.02007	0.15774	0.00181	0.886	-2.1	.	963	12	950	8	944	10
MK-2010-A-154	288	63	.	42948	0.09321	0.00048	3.27613	0.04616	0.25491	0.00334	0.930	-2.1	.	1492	9	1475	11	1464	17
MK-2010-A-156	588	109	.	2482	0.12566	0.00080	3.78330	0.05404	0.21836	0.00279	0.896	-41.3	-40.0	2038	11	1589	11	1273	15
MK-2010-A-157	300	44	.	22435	0.07454	0.00039	1.77834	0.02270	0.17302	0.00202	0.914	-2.8	.	1056	10	1038	8	1029	11
MK-2010-A-158	252	43	.	10700	0.08407	0.00050	2.37301	0.03049	0.20471	0.00233	0.884	-7.9	-5.4	1294	11	1235	9	1201	12

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 8: U-Pb data for MK-2010-7

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios								Disc.‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-7-1	65	4	.	1385	0.05854	0.00047	0.67801	0.01026	0.08400	0.00108	0.850	-5.7	.	550	16	526	6	520	6
MK-2010-7-2	286	10	.	795	0.08067	0.00365	0.62306	0.02931	0.05602	0.00071	0.271	-72.9	-66.4	1213	86	492	18	351	4
MK-2010-7-4	182	7	.	206039	0.05320	0.00030	0.42617	0.00559	0.05810	0.00069	0.900	8.1	.	337	12	360	4	364	4
MK-2010-7-3	448	16	.	18255	0.05315	0.00024	0.39421	0.00509	0.05379	0.00065	0.934	0.8	.	335	10	337	4	338	4
MK-2010-7-5	132	9	.	3850	0.06062	0.00032	0.87101	0.01188	0.10421	0.00131	0.921	2.2	.	626	11	636	6	639	8
MK-2010-7-6	160	10	.	4097	0.05885	0.00033	0.76564	0.01054	0.09436	0.00119	0.913	3.7	.	562	12	577	6	581	7
MK-2010-7-7	27	2	.	847	0.05988	0.00050	0.79175	0.01233	0.09590	0.00126	0.841	-1.5	.	599	18	592	7	590	7
MK-2010-7-8	495	18	.	28174	0.05416	0.00028	0.41458	0.00547	0.05552	0.00068	0.922	-8.0	-1.4	378	10	352	4	348	4
MK-2010-7-9	141	5	.	1455	0.05271	0.00037	0.36111	0.00513	0.04969	0.00061	0.870	-1.2	.	316	15	313	4	313	4
MK-2010-7-10	657	110	.	22949	0.09331	0.00047	3.21049	0.05127	0.24953	0.00379	0.950	-4.3	-2.2	1494	9	1460	12	1436	20
MK-2010-7-11	441	15	.	11507	0.05332	0.00018	0.41082	0.00279	0.05588	0.00033	0.865	2.4	.	342	8	349	2	351	2
MK-2010-7-12	663	66	.	86703	0.07025	0.00023	1.55755	0.01141	0.16081	0.00106	0.897	2.9	0.9	936	6	953	5	961	6
MK-2010-7-13	294	19	.	16268	0.06102	0.00021	0.90604	0.00747	0.10769	0.00080	0.904	3.2	0.3	640	7	655	4	659	5
MK-2010-7-14	572	20	.	13688	0.05343	0.00019	0.41558	0.00287	0.05641	0.00033	0.853	1.9	.	347	8	353	2	354	2
MK-2010-7-15	138	22	.	19828	0.09536	0.00037	3.30654	0.02878	0.25147	0.00195	0.893	-6.5	-5.0	1535	7	1483	7	1446	10
MK-2010-7-16	268	8	.	9023	0.05228	0.00021	0.36219	0.00284	0.05024	0.00034	0.855	6.2	0.1	298	9	314	2	316	2

Table 8 (continued)

Name	U ppm	^{206}Pb ppm	$^{206}Pb_c$* (%)	Ratios $\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	Disc. (%)‡ C.	Min.	Ages (Ma) $\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-7-17	205	34	.	23747	0.09324	0.00039	3.34473	0.02930	0.26018	0.00200	0.879	-0.1	.	1493	8	1492	7	1491	10
MK-2010-7-18	246	32	.	22679	0.08103	0.00032	2.34973	0.01905	0.21031	0.00149	0.874	0.7	.	1222	7	1227	6	1230	8
MK-2010-7-20	262	14	0.06	11593	0.05881	0.00023	0.69100	0.00500	0.08522	0.00052	0.835	-6.1	-2.8	560	8	533	3	527	3
MK-2010-7-21	388	13	.	6640	0.05336	0.00020	0.40697	0.00292	0.05532	0.00034	0.848	0.9	.	344	9	347	2	347	2
MK-2010-7-22	68	11	.	7781	0.09096	0.00040	3.15903	0.02882	0.25188	0.00202	0.879	0.2	.	1446	8	1447	7	1448	10
MK-2010-7-23	63	10	.	8520	0.08995	0.00042	3.00807	0.02692	0.24254	0.00185	0.851	-1.9	.	1424	9	1410	7	1400	10
MK-2010-7-24	78	4	0.32	9584	0.05648	0.00029	0.59285	0.00475	0.07614	0.00046	0.762	0.4	.	471	11	473	3	473	3
MK-2010-7-25	657	21	.	11277	0.05285	0.00020	0.38094	0.00270	0.05227	0.00032	0.853	1.9	.	322	8	328	2	328	2
MK-2010-7-26	40	7	.	6347	0.09592	0.00044	3.44742	0.03200	0.26067	0.00210	0.868	-3.8	-2.0	1546	8	1515	7	1493	11
MK-2010-7-27	197	11	.	6311	0.05890	0.00022	0.77747	0.00604	0.09573	0.00065	0.871	4.8	1.4	563	8	584	3	589	4
MK-2010-7-28	837	27	0.24	17872	0.05289	0.00028	0.38967	0.00427	0.05343	0.00051	0.876	3.6	.	324	12	334	3	336	3
MK-2010-7-29	708	49	0.43	3574	0.06339	0.00030	0.99715	0.00860	0.11408	0.00083	0.841	-3.7	-0.5	721	9	702	4	696	5
MK-2010-7-30	104	16	.	10583	0.09108	0.00041	3.11015	0.03075	0.24766	0.00218	0.888	-1.7	.	1448	8	1435	8	1426	11
MK-2010-7-31	724	25	.	13435	0.05330	0.00019	0.41539	0.00289	0.05652	0.00034	0.854	3.8	.	342	8	353	2	354	2
MK-2010-7-32	247	27	.	18343	0.07479	0.00029	1.84959	0.01478	0.17936	0.00126	0.877	0.1	.	1063	7	1063	5	1063	7
MK-2010-7-33	863	29	.	23828	0.05347	0.00021	0.41515	0.00306	0.05631	0.00035	0.851	1.3	.	349	9	353	2	353	2
MK-2010-7-35	791	30	0.08	14312	0.05475	0.00023	0.47047	0.00365	0.06232	0.00041	0.847	-3.2	.	402	9	392	3	390	2
MK-2010-7-36	212	57	.	140221	0.15427	0.00105	8.85968	0.11767	0.41652	0.00475	0.859	-7.4	-5.4	2394	11	2324	12	2245	22
MK-2010-7-37	112	11	.	7580	0.06956	0.00043	1.43799	0.02433	0.14993	0.00236	0.931	-1.7	.	915	12	905	10	901	13
MK-2010-7-38	44	5	.	3224	0.07457	0.00035	1.88534	0.01659	0.18336	0.00137	0.848	2.9	0.4	1057	10	1076	6	1085	7
MK-2010-7-39	95	11	.	12949	0.07436	0.00032	1.89719	0.01692	0.18503	0.00145	0.877	4.4	2.0	1051	8	1080	6	1094	8
MK-2010-7-40	263	15	.	11905	0.05890	0.00023	0.77315	0.00592	0.09521	0.00063	0.864	4.3	0.9	563	8	582	3	586	4
MK-2010-7-41	463	16	.	16108	0.05323	0.00021	0.42959	0.00331	0.05853	0.00039	0.863	8.6	3.1	339	8	363	2	367	2
MK-2010-7-42	239	8	.	10055	0.05335	0.00023	0.40626	0.00331	0.05523	0.00038	0.845	0.9	.	344	9	346	2	347	2
MK-2010-7-43	84	3	.	13038	0.05281	0.00035	0.38867	0.00361	0.05337	0.00035	0.705	4.6	.	321	14	333	3	335	2
MK-2010-7-44	158	8	.	4207	0.05727	0.00028	0.64005	0.00540	0.08105	0.00056	0.822	0.1	.	502	10	502	3	502	3
MK-2010-7-45	1131	40	.	20070	0.05385	0.00020	0.43405	0.00328	0.05846	0.00038	0.870	0.5	.	365	8	366	2	366	2
MK-2010-7-46	69	17	.	16254	0.12952	0.00067	6.60914	0.07900	0.37009	0.00399	0.902	-3.4	-1.7	2091	8	2061	11	2030	19
MK-2010-7-47	89	11	.	9590	0.07820	0.00034	2.16231	0.02027	0.20055	0.00167	0.887	2.5	0.1	1152	8	1169	7	1178	9
MK-2010-7-48	215	7	.	4713	0.05389	0.00031	0.39348	0.00355	0.05296	0.00037	0.769	-9.5	-2.2	366	12	337	3	333	2
MK-2010-7-49	146	23	.	22206	0.09382	0.00041	3.32833	0.03150	0.25728	0.00216	0.888	-2.1	-0.3	1505	8	1488	7	1476	11
MK-2010-7-50	227	8	.	5239	0.05316	0.00026	0.40399	0.00336	0.05512	0.00037	0.802	3.1	.	336	11	345	2	346	2
MK-2010-7-51	168	23	.	7499	0.09658	0.00047	2.88434	0.03906	0.21660	0.00274	0.933	-20.8	-19.2	1559	9	1378	10	1264	14
MK-2010-7-52	638	21	1.30	1001	0.05293	0.00029	0.41446	0.00396	0.05679	0.00044	0.818	9.5	2.1	326	12	352	3	356	3
MK-2010-7-53	48	8	.	4734	0.09235	0.00044	3.32655	0.03275	0.26126	0.00226	0.878	1.7	.	1475	8	1487	8	1496	12
MK-2010-7-54	128	21	.	22234	0.09379	0.00042	3.41903	0.03426	0.26440	0.00237	0.895	0.6	.	1504	8	1509	8	1512	12
MK-2010-7-55	148	8	.	2980	0.05858	0.00027	0.71382	0.00601	0.08838	0.00062	0.835	-1.1	.	552	10	547	4	546	4
MK-2010-7-56	83	11	1.30	1139	0.07174	0.00037	1.33030	0.01042	0.13449	0.00080	0.757	-17.9	-15.8	978	10	859	5	813	5
MK-2010-7-57	604	228	.	84435	0.12896	0.00050	6.49771	0.05253	0.36544	0.00259	0.876	-4.2	-3.0	2084	7	2046	7	2008	12
MK-2010-7-58	733	47	0.27	12417	0.05502	0.00034	0.49168	0.00883	0.06481	0.00109	0.938	-2.1	.	413	14	406	6	405	7
MK-2010-7-59	668	37	.	6966	0.05307	0.00018	0.41454	0.00231	0.05665	0.00025	0.797	7.2	2.9	332	7	352	2	355	2
MK-2010-7-60	410	23	.	5746	0.05308	0.00021	0.41028	0.00247	0.05606	0.00025	0.748	5.9	1.2	332	9	349	2	352	2

Table 8 (continued)

Name	U	^{206}Pb	^{206}Pb$_c$*	Ratios							Rho	Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ		C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-7-61	665	34	.	16913	0.05250	0.00018	0.38272	0.00224	0.05287	0.00025	0.816	8.2	3.4	307	8	329	2	332	2
MK-2010-7-62	167	9	.	3223	0.05300	0.00033	0.40629	0.00311	0.05559	0.00025	0.576	6.2	0.6	329	14	346	2	349	1
MK-2010-7-63	54	9	.	1527	0.07031	0.00035	1.54670	0.01128	0.15954	0.00085	0.733	1.9	.	937	10	949	4	954	5
MK-2010-7-64	129	25	.	6633	0.07698	0.00028	2.03989	0.01285	0.19218	0.00099	0.821	1.2	.	1121	7	1129	4	1133	5
MK-2010-7-65	1220	68	.	20430	0.05322	0.00016	0.41846	0.00232	0.05703	0.00026	0.831	5.9	1.8	338	7	355	2	358	2
MK-2010-7-66	90	14	0.49	4314	0.07621	0.00030	1.64456	0.01112	0.15651	0.00086	0.814	-15.9	-14.3	1101	8	987	4	937	5
MK-2010-7-67	345	19	.	6173	0.05310	0.00022	0.41131	0.00252	0.05617	0.00026	0.746	5.9	1.1	333	9	350	2	352	2
MK-2010-7-68	406	122	.	29580	0.10295	0.00036	4.20111	0.03033	0.29598	0.00188	0.877	-0.4	.	1678	6	1674	6	1671	9
MK-2010-7-69	469	45	.	20573	0.05933	0.00018	0.79326	0.00436	0.09697	0.00044	0.828	3.1	0.6	579	7	593	2	597	3
MK-2010-7-70	21	4	.	1299	0.07623	0.00056	1.79262	0.01948	0.17055	0.00136	0.735	-8.4	-5.3	1101	14	1043	7	1015	8
MK-2010-7-71	300	56	.	7363	0.07786	0.00026	2.01010	0.01285	0.18723	0.00102	0.852	-3.5	-1.9	1143	6	1119	4	1106	6
MK-2010-7-72	525	29	.	12134	0.05361	0.00019	0.41469	0.00245	0.05611	0.00026	0.800	-0.8	.	355	7	352	2	352	2
MK-2010-7-73	140	31	0.82	3688	0.08426	0.00090	2.54359	0.03101	0.21893	0.00128	0.480	-1.9	.	1299	19	1285	9	1276	7
MK-2010-7-74	472	49	.	10305	0.06101	0.00019	0.89543	0.00515	0.10644	0.00052	0.849	2.0	.	640	6	649	3	652	3
MK-2010-7-75	557	105	.	19715	0.07759	0.00024	2.03528	0.01307	0.19025	0.00107	0.876	-1.3	.	1136	6	1127	4	1123	6
MK-2010-7-76	79	11	.	4847	0.09860	0.00067	1.84661	0.02346	0.13583	0.00146	0.844	-51.7	-50.4	1598	12	1062	8	821	8
MK-2010-7-77	732	42	.	8575	0.05323	0.00017	0.43023	0.00245	0.05862	0.00028	0.825	8.7	4.4	339	7	363	2	367	2
MK-2010-7-78	137	44	.	14439	0.10955	0.00041	4.71570	0.03636	0.31221	0.00211	0.875	-2.6	-1.2	1792	7	1770	6	1752	10
MK-2010-A-159	144	31	.	17051	0.09264	0.00057	3.04934	0.03212	0.23874	0.00204	0.811	-7.5	-5.3	1480	11	1420	8	1380	11
MK-2010-A-160	526	37	.	13336	0.05792	0.00031	0.63430	0.00547	0.07943	0.00054	0.791	-6.7	-2.0	527	11	499	3	493	3
MK-2010-A-162	69	11	.	13832	0.07485	0.00049	1.81913	0.01959	0.17626	0.00150	0.793	-1.8	.	1065	13	1052	7	1047	8
MK-2010-A-163	471	29	.	6708	0.05544	0.00030	0.53308	0.00470	0.06974	0.00049	0.793	1.1	.	430	12	434	3	435	3
MK-2010-A-164	1361	191	.	4355	0.07251	0.00038	1.57172	0.01792	0.15722	0.00159	0.887	-6.3	-3.5	1000	11	959	7	941	9
MK-2010-A-165	362	62	.	35128	0.07759	0.00043	2.04105	0.02052	0.19079	0.00161	0.837	-1.0	.	1136	11	1129	7	1126	9
MK-2010-A-166	165	13	.	3987	0.05886	0.00046	0.69541	0.00884	0.08569	0.00085	0.784	-5.9	.	562	16	536	5	530	5
MK-2010-A-167	886	60	0.27	4950	0.05788	0.00031	0.61171	0.00592	0.07666	0.00061	0.828	-9.7	-5.0	525	12	485	4	476	4
MK-2010-A-168	258	63	.	19761	0.09830	0.00060	3.62777	0.04158	0.26766	0.00260	0.848	-4.5	-2.2	1592	11	1556	9	1529	13
MK-2010-A-169	263	54	.	19573	0.08580	0.00049	2.68116	0.02646	0.22663	0.00182	0.814	-1.4	.	1334	10	1323	7	1317	10
MK-2010-A-170	43	6	.	1606	0.07074	0.00052	1.56887	0.01775	0.16085	0.00139	0.762	1.3	.	950	15	958	7	961	8
MK-2010-A-171	447	73	.	17129	0.07539	0.00041	1.90605	0.01790	0.18337	0.00140	0.811	0.7	.	1079	10	1083	6	1085	8
MK-2010-A-172	93	15	.	14853	0.07905	0.00048	1.97278	0.01967	0.18100	0.00143	0.794	-9.3	-6.8	1173	12	1106	7	1072	8
MK-2010-A-173	653	153	0.19	7101	0.09718	0.00064	3.42200	0.03838	0.25538	0.00233	0.812	-7.4	-5.1	1571	12	1509	9	1466	12
MK-2010-A-175	482	24	.	5822	0.05326	0.00030	0.41365	0.00357	0.05632	0.00037	0.767	4.0	.	340	12	351	3	353	2
MK-2010-A-176	1099	54	.	11072	0.05380	0.00027	0.41758	0.00351	0.05629	0.00038	0.798	-2.7	.	363	11	354	3	353	2
MK-2010-A-177	273	18	.	4293	0.05616	0.00033	0.58239	0.00507	0.07521	0.00049	0.742	1.9	.	459	13	466	3	467	3
MK-2010-A-178	184	8	.	4178	0.05260	0.00044	0.38259	0.00457	0.05275	0.00045	0.708	6.6	.	311	19	329	3	331	3
MK-2010-A-179	461	23	.	7880	0.05269	0.00030	0.40938	0.00362	0.05635	0.00038	0.770	12.3	4.8	316	12	348	3	353	2
MK-2010-A-180	168	23	.	10850	0.06897	0.00039	1.46309	0.01364	0.15385	0.00114	0.797	3.0	.	898	11	915	6	923	6
MK-2010-A-181	436	113	.	27321	0.10002	0.00060	3.95015	0.04419	0.28642	0.00270	0.842	-0.1	.	1625	11	1624	9	1624	14
MK-2010-A-182	363	88	.	24718	0.09911	0.00059	3.67337	0.04076	0.26881	0.00252	0.845	-5.1	-2.9	1607	11	1566	9	1535	13
MK-2010-A-183	147	8	.	6100	0.05482	0.00043	0.45200	0.00473	0.05980	0.00042	0.667	-7.7	.	405	16	379	3	374	3
MK-2010-A-184	67	13	.	3664	0.08551	0.00053	2.58904	0.02703	0.21960	0.00185	0.807	-3.9	-1.4	1327	11	1298	8	1280	10

Table 8 (continued)

Name	U	^{206}Pb	$^{206}Pb_c*$	Ratios								Disc. (%)‡		Ages (Ma)					
	ppm	ppm	(%)	$\frac{^{206}Pb}{^{204}Pb}$	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ	Rho	C.	Min.	$\frac{^{207}Pb}{^{206}Pb}$	1σ	$\frac{^{207}Pb}{^{235}U}$	1σ	$\frac{^{206}Pb}{^{238}U}$	1σ
MK-2010-A-185	309	93	.	35515	0.12373	0.00086	5.62974	0.06743	0.33000	0.00322	0.816	-9.8	-7.8	2011	12	1921	10	1838	16
MK-2010-A-186	319	15	0.33	3789	0.05477	0.00038	0.41235	0.00406	0.05460	0.00038	0.707	-15.3	-7.8	403	15	351	3	343	2
MK-2010-A-187	69	17	.	26929	0.09847	0.00065	3.70661	0.04190	0.27302	0.00251	0.815	-2.8	-0.4	1595	12	1573	9	1556	13
MK-2010-A-188	739	35	.	12717	0.05367	0.00031	0.40918	0.00370	0.05530	0.00038	0.767	-2.9	.	357	13	348	3	347	2
MK-2010-A-189	20	3	.	1025	0.07526	0.00062	1.87921	0.02301	0.18109	0.00165	0.742	-0.3	.	1076	16	1074	8	1073	9
MK-2010-A-190	111	23	.	6186	0.08538	0.00053	2.68766	0.02807	0.22831	0.00192	0.807	0.1	.	1324	12	1325	8	1326	10
MK-2010-A-191	88	16	.	16341	0.08085	0.00053	2.24526	0.02345	0.20141	0.00165	0.783	-3.1	-0.4	1218	12	1195	7	1183	9
MK-2010-A-192	2155	90	0.16	11600	0.05329	0.00029	0.35647	0.00418	0.04852	0.00050	0.888	-10.7	-3.4	341	11	310	3	305	3
MK-2010-A-193	890	64	.	25611	0.05666	0.00031	0.64803	0.00581	0.08296	0.00059	0.798	7.7	2.7	478	12	507	4	514	4
MK-2010-A-194	691	34	.	16457	0.05284	0.00029	0.41989	0.00368	0.05763	0.00040	0.786	12.5	5.3	322	12	356	3	361	2
MK-2010-A-195	151	34	.	12391	0.09244	0.00055	3.25413	0.03485	0.25531	0.00227	0.830	-0.8	.	1476	11	1470	8	1466	12
MK-2010-A-196	91	16	.	9907	0.07859	0.00049	2.17111	0.02252	0.20037	0.00166	0.797	1.5	.	1162	12	1172	7	1177	9
MK-2010-A-197	111	47	.	11110	0.16728	0.00142	10.54502	0.15754	0.45720	0.00562	0.823	-4.9	-2.5	2531	14	2484	14	2427	25
MK-2010-A-198	160	30	.	16795	0.08408	0.00055	2.49741	0.03096	0.21544	0.00227	0.849	-3.1	-0.2	1294	12	1271	9	1258	12
MK-2010-A-199	378	33	.	15860	0.06002	0.00033	0.84258	0.00771	0.10181	0.00075	0.802	3.6	.	604	11	621	4	625	4
MK-2010-A-200	83	21	0.20	4098	0.10094	0.00068	3.84123	0.04387	0.27601	0.00255	0.808	-4.8	-2.5	1641	12	1601	9	1571	13
MK-2010-A-201	172	38	.	10575	0.09526	0.00061	3.28418	0.04086	0.25003	0.00266	0.855	-6.9	-4.5	1533	12	1477	10	1439	14

Notes: *) Percentage of nonradiogenic ^{206}Pb. ‡) Degree of discordance, C = discordance at the centre of an error ellipse; Min. = minimum possible discordance at the rim of an error ellipse; blank cells denote a concordant age.

Table 9: Lu-Hf data for MK-2010-1 and MK-2010-6

Name	Measured ratios								Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ							
MK-2010-1-1^{d}	1.46720	0.00003	0.09024	0.00260	0.282341	0.000014	0.002022	0.000030	0.783	0.282311	0.000028	0.7	1.0	1.31	1.59
MK-2010-1-2	1.46731	0.00005	0.03370	0.00120	0.282476	0.000014	0.000808	0.000064	0.354	0.282471	0.000028	-3.2	1.0	1.08	1.51
MK-2010-6-2	1.46726	0.00003	0.06190	0.00280	0.281962	0.000012	0.001133	0.000040	1.428	0.281931	0.000024	1.9	0.9	1.80	2.02
MK-2010-6-3^{d}	1.46732	0.00003	0.05209	0.00190	0.282330	0.000014	0.001326	0.000091	0.594	0.282315	0.000028	-3.4	1.0	1.30	1.70
MK-2010-6-5	1.46722	0.00003	0.11801	0.00170	0.281964	0.000015	0.002273	0.000025	1.396	0.281904	0.000030	0.2	1.1	1.85	2.10
MK-2010-6-6	1.46727	0.00003	0.01092	0.00029	0.281386	0.000011	0.000219	0.000003	1.855	0.281378	0.000022	-7.9	0.8	2.53	2.94

Notes: ∗) Reported ages are the ^{206}Pb/^{238}U ages if younger than or equal to 0.6 Ga, otherwise the ^{206}Pb/^{207}Pb ages are used. †) Initial ^{176}Hf/^{177}Hf value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a ^{176}Lu/^{177}Hf ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.

Table 10: Lu-Hf data for MK-2010-2

	Measured ratios														
Name	$\frac{^{178}\mathrm{Hf}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{177}\mathrm{Yb}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{176}\mathrm{Lu}}{^{177}\mathrm{Hf}}$	1σ	Age (Ga)*	$\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-2-1	1.46725	0.00003	0.09562	0.00290	0.281809	0.000011	0.002395	0.000070	1.635	0.281735	0.000022	-0.3	0.8	2.08	2.31
MK-2010-2-3	1.46717	0.00004	0.03712	0.00080	0.281827	0.000011	0.000911	0.000032	1.289	0.281805	0.000022	-5.7	0.8	1.97	2.38
MK-2010-2-4	1.46730	0.00002	0.01700	0.00012	0.281639	0.000011	0.000383	0.000006	1.752	0.281626	0.000022	-1.5	0.8	2.20	2.47
MK-2010-2-5	1.46724	0.00002	0.03123	0.00053	0.281433	0.000013	0.000697	0.000008	1.777	0.281409	0.000026	-8.6	0.9	2.50	2.92
MK-2010-2-6	1.46726	0.00002	0.04209	0.00056	0.282350	0.000012	0.000920	0.000013	0.573	0.282340	0.000024	-3.0	0.8	1.26	1.66
MK-2010-2-8	1.46729	0.00004	0.02606	0.00031	0.281886	0.000016	0.000560	0.000009	1.440	0.281871	0.000032	0.0	1.1	1.88	2.14
MK-2010-2-9	1.46725	0.00003	0.02852	0.00028	0.281827	0.000012	0.000646	0.000006	1.457	0.281809	0.000024	-1.7	0.9	1.96	2.26
MK-2010-2-10	1.46722	0.00004	0.02147	0.00017	0.281056	0.000013	0.000492	0.000007	2.844	0.281029	0.000026	2.7	0.9	2.98	3.07
MK-2010-2-11	1.46724	0.00003	0.08159	0.00074	0.282399	0.000014	0.001736	0.000028	0.347	0.282388	0.000028	-6.3	1.0	1.22	1.69
MK-2010-2-12	1.46723	0.00004	0.03059	0.00050	0.282748	0.000011	0.000674	0.000021	0.448	0.282742	0.000022	8.5	0.8	0.70	0.85
MK-2010-2-13	1.46729	0.00003	0.04414	0.00250	0.281948	0.000013	0.000891	0.000051	1.454	0.281923	0.000026	2.2	0.9	1.81	2.02
MK-2010-2-14	1.46723	0.00004	0.05910	0.00055	0.281757	0.000013	0.001256	0.000006	1.627	0.281718	0.000026	-1.1	0.9	2.09	2.35
MK-2010-2-15	1.46720	0.00004	0.06522	0.00150	0.282241	0.000014	0.001393	0.000023	0.929	0.282217	0.000028	0.7	1.0	1.43	1.71
MK-2010-2-16	1.46719	0.00004	0.05856	0.00096	0.281765	0.000011	0.001280	0.000027	1.718	0.281723	0.000022	1.2	0.8	2.08	2.29
MK-2010-2-17	1.46734	0.00007	0.05782	0.00056	0.281830	0.000023	0.001288	0.000012	1.601	0.281791	0.000046	0.9	1.6	1.99	2.21
MK-2010-2-19	1.46715	0.00003	0.04110	0.00110	0.282260	0.000016	0.000884	0.000027	0.654	0.282249	0.000032	-4.4	1.1	1.38	1.81
MK-2010-2-20	1.46722	0.00004	0.01003	0.00029	0.282136	0.000012	0.000219	0.000006	1.446	0.282130	0.000024	9.4	0.9	1.52	1.57
MK-2010-2-22	1.46723	0.00003	0.04569	0.00120	0.281826	0.000013	0.001061	0.000025	1.649	0.281793	0.000026	2.1	0.9	1.98	2.18
MK-2010-2-23	1.46726	0.00002	0.02560	0.00031	0.282207	0.000012	0.000548	0.000005	0.969	0.282197	0.000024	0.9	0.9	1.44	1.73
MK-2010-2-24	1.46725	0.00003	0.03231	0.00089	0.282062	0.000016	0.000749	0.000025	1.188	0.282045	0.000032	0.5	1.1	1.65	1.92
MK-2010-2-25	1.46728	0.00003	0.03012	0.00067	0.282203	0.000014	0.000671	0.000011	1.190	0.282188	0.000028	5.6	1.0	1.45	1.61
MK-2010-2-26	1.46718	0.00004	0.02249	0.00120	0.282259	0.000013	0.000470	0.000027	0.926	0.282251	0.000026	1.8	0.9	1.37	1.63
MK-2010-2-27	1.46720	0.00004	0.02987	0.00047	0.281878	0.000015	0.000743	0.000038	1.665	0.281855	0.000030	4.6	1.1	1.90	2.04
MK-2010-2-28[d]	1.46728	0.00004	0.02889	0.00170	0.282572	0.000016	0.000703	0.000022	0.298	0.282568	0.000032	-1.0	1.1	0.94	1.33
MK-2010-2-29	1.46731	0.00003	0.03111	0.00140	0.282005	0.000015	0.000672	0.000041	1.489	0.281986	0.000030	5.3	1.1	1.72	1.86
MK-2010-2-30[d]	1.46730	0.00003	0.08891	0.00290	0.281897	0.000010	0.002413	0.000160	1.534	0.281827	0.000020	0.6	0.7	1.96	2.18
MK-2010-2-31	1.46735	0.00005	0.02418	0.00047	0.282242	0.000011	0.000544	0.000022	0.994	0.282232	0.000022	2.7	0.8	1.39	1.63
MK-2010-2-33	1.46725	0.00003	0.03921	0.00130	0.281768	0.000014	0.000848	0.000030	1.650	0.281741	0.000028	0.3	1.0	2.05	2.29
MK-2010-2-34[d]	1.46716	0.00004	0.03299	0.00079	0.281882	0.000015	0.000756	0.000020	1.646	0.281858	0.000030	4.3	1.1	1.89	2.04
MK-2010-2-36	1.46720	0.00003	0.04240	0.00080	0.281672	0.000015	0.000994	0.000015	1.781	0.281638	0.000030	-0.4	1.1	2.19	2.43
MK-2010-2-37	1.46728	0.00004	0.03547	0.00088	0.282076	0.000011	0.001074	0.000067	1.128	0.282053	0.000022	-0.6	0.8	1.64	1.94
MK-2010-2-38	1.46720	0.00003	0.02066	0.00053	0.282041	0.000015	0.000516	0.000027	1.156	0.282030	0.000030	-0.8	1.1	1.67	1.97
MK-2010-2-39	1.46724	0.00004	0.10098	0.00420	0.281844	0.000018	0.002414	0.000080	1.653	0.281768	0.000036	1.3	1.3	2.03	2.23
MK-2010-2-40	1.46724	0.00003	0.03750	0.00097	0.282124	0.000012	0.000826	0.000013	1.173	0.282106	0.000024	2.3	0.9	1.57	1.80
MK-2010-2-42	1.46716	0.00003	0.16894	0.00350	0.281819	0.000015	0.003556	0.000076	1.612	0.281710	0.000030	-1.7	1.1	2.13	2.38
MK-2010-2-43	1.46735	0.00004	0.03310	0.00092	0.282144	0.000013	0.000699	0.000017	1.028	0.282130	0.000026	-0.1	0.9	1.53	1.83
MK-2010-2-44[d]	1.46727	0.00003	0.03736	0.00037	0.282705	0.000013	0.000958	0.000007	0.361	0.282699	0.000026	5.0	0.9	0.77	1.00
MK-2010-2-45[d]	1.46718	0.00003	0.04113	0.00058	0.282543	0.000013	0.000900	0.000015	0.353	0.282537	0.000026	-0.9	0.9	0.99	1.36
MK-2010-2-46	1.46728	0.00002	0.02292	0.00068	0.281592	0.000012	0.000533	0.000014	1.768	0.281574	0.000024	-3.0	0.9	2.27	2.58
MK-2010-2-47	1.46719	0.00005	0.01897	0.00025	0.282171	0.000022	0.000410	0.000005	1.033	0.282163	0.000044	1.1	1.6	1.48	1.76
MK-2010-2-48	1.46723	0.00003	0.03125	0.00055	0.282177	0.000013	0.000652	0.000008	1.007	0.282165	0.000026	0.6	0.9	1.49	1.77

Table 10 (continued)

Name	Measured ratios								Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ							
MK-2010-2-50	1.46726	0.00005	0.02967	0.00130	0.281118	0.000014	0.000725	0.000025	2.649	0.281081	0.000028	0.0	1.0	2.92	3.08
MK-2010-2-53	1.46726	0.00004	0.04327	0.00092	0.281798	0.000016	0.001293	0.000054	1.597	0.281759	0.000032	-0.3	1.1	2.03	2.28
MK-2010-2-54	1.46724	0.00003	0.01217	0.00024	0.281050	0.000012	0.000280	0.000005	2.762	0.281035	0.000024	1.0	0.9	2.97	3.11
MK-2010-2-55	1.46728	0.00004	0.03803	0.00130	0.282220	0.000015	0.000832	0.000034	1.195	0.282201	0.000030	6.2	1.1	1.43	1.58
MK-2010-2-56	1.46724	0.00003	0.02455	0.00150	0.281075	0.000018	0.000579	0.000036	1.599	0.281057	0.000036	-25.2	1.3	2.96	3.78
MK-2010-2-57	1.46725	0.00003	0.04171	0.00530	0.281627	0.000016	0.001422	0.000220	1.755	0.281580	0.000032	-3.1	1.1	2.28	2.57
MK-2010-2-58	1.46723	0.00003	0.01353	0.00028	0.282053	0.000012	0.000303	0.000006	0.965	0.282047	0.000024	-4.5	0.9	1.64	2.05
MK-2010-2-59	1.46728	0.00002	0.02393	0.00043	0.282118	0.000013	0.000501	0.000007	1.108	0.282108	0.000026	0.9	0.9	1.56	1.83
MK-2010-2-60	1.46727	0.00003	0.03020	0.00025	0.282145	0.000009	0.000623	0.000002	1.129	0.282132	0.000018	2.2	0.6	1.53	1.77
MK-2010-2-61	1.46725	0.00003	0.02001	0.00007	0.281721	0.000011	0.000442	0.000002	1.423	0.281709	0.000022	-6.1	0.8	2.09	2.50
MK-2010-2-62	1.46728	0.00004	0.02676	0.00047	0.282121	0.000012	0.000573	0.000006	1.123	0.282109	0.000024	1.3	0.9	1.56	1.82
MK-2010-2-63	1.46726	0.00003	0.02859	0.00022	0.282253	0.000010	0.000545	0.000001	1.028	0.282242	0.000020	3.8	0.7	1.38	1.59
MK-2010-2-64	1.46732	0.00004	0.01900	0.00007	0.282217	0.000015	0.000399	0.000001	0.967	0.282210	0.000030	1.3	1.1	1.42	1.70
MK-2010-2-65	1.46727	0.00004	0.02186	0.00081	0.282031	0.000016	0.000447	0.000019	1.199	0.282021	0.000032	-0.1	1.1	1.68	1.97
MK-2010-2-66[d]	1.46721	0.00003	0.09427	0.00560	0.281908	0.000012	0.001930	0.000072	1.453	0.281855	0.000024	-0.2	0.9	1.91	2.17
MK-2010-2-67	1.46729	0.00004	0.02672	0.00038	0.282130	0.000014	0.000536	0.000010	0.954	0.282120	0.000028	-2.2	1.0	1.55	1.90
MK-2010-2-70	1.46726	0.00004	0.03117	0.00051	0.282052	0.000014	0.000680	0.000021	1.177	0.282037	0.000028	-0.1	1.0	1.66	1.94
MK-2010-2-71	1.46734	0.00004	0.02150	0.00042	0.282117	0.000014	0.000511	0.000012	0.934	0.282108	0.000028	-3.0	1.0	1.56	1.94
MK-2010-2-76	1.46729	0.00003	0.12601	0.00580	0.281991	0.000015	0.002775	0.000078	1.512	0.281912	0.000030	3.1	1.1	1.84	2.01
MK-2010-2-77	1.46725	0.00004	0.02900	0.00048	0.281937	0.000015	0.000624	0.000008	1.070	0.281924	0.000030	-6.5	1.1	1.81	2.25
MK-2010-2-78	1.46741	0.00005	0.02999	0.00160	0.282182	0.000016	0.000819	0.000086	1.048	0.282166	0.000032	1.6	1.1	1.49	1.74
MK-2010-2-79	1.46732	0.00004	0.03089	0.00094	0.282138	0.000012	0.000914	0.000073	0.990	0.282121	0.000024	-1.3	0.9	1.55	1.88
MK-2010-2-80	1.46738	0.00004	0.03305	0.00027	0.281925	0.000012	0.000706	0.000003	1.239	0.281908	0.000024	-3.2	0.9	1.83	2.18
MK-2010-2-81	1.46728	0.00004	0.03613	0.00100	0.282315	0.000014	0.001009	0.000057	0.365	0.282308	0.000028	-9.1	1.3	1.31	1.86
MK-2010-2-82	1.46720	0.00003	0.04839	0.00210	0.281885	0.000018	0.001316	0.000120	1.635	0.281844	0.000036	3.6	1.3	1.92	2.08
MK-2010-2-83	1.46734	0.00004	0.04199	0.00170	0.282232	0.000017	0.000813	0.000024	1.019	0.282216	0.000034	2.7	1.2	1.42	1.65
MK-2010-2-84	1.46729	0.00004	0.02009	0.00110	0.281963	0.000021	0.000507	0.000016	1.597	0.281948	0.000042	6.4	1.5	1.77	1.88
MK-2010-2-85	1.46731	0.00003	0.03089	0.00077	0.282183	0.000011	0.000648	0.000015	1.133	0.282169	0.000022	3.6	0.8	1.48	1.68
MK-2010-2-86	1.46730	0.00004	0.07197	0.00300	0.282124	0.000016	0.001434	0.000056	1.174	0.282092	0.000032	1.8	1.1	1.59	1.83
MK-2010-2-87	1.46720	0.00004	0.03325	0.00028	0.282143	0.000016	0.000819	0.000036	0.594	0.282134	0.000032	-9.8	1.1	1.54	2.09
MK-2010-2-88	1.46727	0.00004	0.02853	0.00082	0.282159	0.000015	0.000577	0.000011	0.939	0.282149	0.000030	-1.5	1.1	1.51	1.85
MK-2010-2-95	1.46734	0.00003	0.02499	0.00050	0.281863	0.000012	0.000541	0.000009	1.613	0.281846	0.000024	3.1	0.9	1.91	2.09
MK-2010-A-1	1.46727	0.00004	0.04712	0.00300	0.282191	0.000010	0.001067	0.000035	1.123	0.282168	0.000019	3.4	0.7	1.48	1.69
MK-2010-A-2	1.46727	0.00002	0.03290	0.00022	0.282190	0.000012	0.000593	0.000004	0.957	0.282179	0.000024	0.0	0.9	1.47	1.77
MK-2010-A-3	1.46726	0.00005	0.05323	0.00080	0.281752	0.000023	0.001138	0.000059	1.757	0.281714	0.000046	1.8	1.6	2.09	2.28
MK-2010-A-4	1.46722	0.00004	0.04593	0.00150	0.282116	0.000011	0.000880	0.000064	1.046	0.282099	0.000022	-0.8	0.8	1.58	1.89
MK-2010-A-5	1.46728	0.00003	0.03376	0.00082	0.282131	0.000012	0.000599	0.000011	1.033	0.282119	0.000024	-0.4	0.9	1.55	1.85
MK-2010-A-6	1.46721	0.00003	0.08377	0.00440	0.282595	0.000012	0.002000	0.000074	0.353	0.282582	0.000024	0.7	0.8	0.94	1.27
MK-2010-A-7a	1.46724	0.00003	0.05024	0.00031	0.281845	0.000014	0.000937	0.000007	1.630	0.281816	0.000028	2.5	1.0	1.95	2.14
MK-2010-A-7b	1.46732	0.00002	0.07868	0.00290	0.282227	0.000010	0.001863	0.000170	1.127	0.282187	0.000020	4.1	0.7	1.46	1.65
MK-2010-A-8	1.46729	0.00003	0.05193	0.00160	0.281941	0.000012	0.000921	0.000020	1.505	0.281915	0.000024	3.1	0.9	1.82	2.00
MK-2010-A-9	1.46719	0.00004	0.07328	0.00110	0.281805	0.000012	0.001327	0.000012	1.673	0.281763	0.000024	1.6	0.9	2.03	2.23
MK-2010-A-10	1.46729	0.00003	0.03643	0.00089	0.282111	0.000016	0.000624	0.000012	0.944	0.282100	0.000032	-3.1	1.1	1.57	1.95

Table 10 (continued)

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-A-11	1.46724	0.00003	0.03949	0.00060	0.282266	0.000012	0.000692	0.000017	0.931	0.282254	0.000024	2.1	0.9	1.37	1.62
MK-2010-A-12	1.46722	0.00005	0.04722	0.00370	0.282108	0.000017	0.001338	0.000160	1.003	0.282083	0.000034	-2.4	1.2	1.61	1.95
MK-2010-A-13	1.46726	0.00004	0.05235	0.00100	0.281824	0.000015	0.000999	0.000009	1.631	0.281793	0.000030	1.7	1.1	1.98	2.19
MK-2010-A-14	1.46724	0.00003	0.04499	0.00140	0.282219	0.000010	0.000800	0.000029	0.945	0.282205	0.000019	0.6	0.7	1.43	1.72
MK-2010-A-15	1.46718	0.00005	0.07344	0.00190	0.282151	0.000015	0.001763	0.000130	1.028	0.282117	0.000030	-0.6	1.1	1.57	1.86
MK-2010-A-16	1.46731	0.00004	0.02937	0.00065	0.282138	0.000012	0.000597	0.000009	1.164	0.282125	0.000024	2.8	0.9	1.54	1.76
MK-2010-A-17	1.46724	0.00003	0.06100	0.00200	0.282530	0.000012	0.001062	0.000035	0.359	0.282523	0.000024	-1.8	1.4	1.01	1.39
MK-2010-A-18	1.46724	0.00003	0.03510	0.00230	0.280992	0.000012	0.000658	0.000065	2.716	0.280958	0.000024	-2.8	0.9	3.08	3.30
MK-2010-A-19	1.46720	0.00004	0.21479	0.00750	0.282545	0.000020	0.003992	0.000085	0.481	0.282509	0.000040	1.0	1.4	1.07	1.35
MK-2010-A-20	1.46726	0.00003	0.04353	0.00170	0.280794	0.000018	0.000783	0.000032	2.728	0.280753	0.000036	-9.8	1.3	3.35	3.72
MK-2010-A-21	1.46733	0.00004	0.09862	0.00280	0.281776	0.000020	0.002598	0.000230	1.694	0.281693	0.000040	-0.5	1.4	2.14	2.37
MK-2010-A-22	1.46720	0.00003	0.05760	0.00280	0.282078	0.000013	0.001164	0.000110	0.581	0.282065	0.000026	-12.5	0.9	1.64	2.25
MK-2010-A-23	1.46726	0.00004	0.05850	0.00130	0.282191	0.000013	0.001079	0.000025	1.054	0.282170	0.000026	1.9	0.9	1.48	1.73
MK-2010-A-24	1.46722	0.00002	0.02884	0.00089	0.281871	0.000015	0.000548	0.000011	1.658	0.281854	0.000030	4.4	1.1	1.90	2.04
MK-2010-A-25b	1.46726	0.00007	0.14130	0.00610	0.282224	0.000040	0.004128	0.000180	0.321	0.282199	0.000080	-13.6	2.8	1.56	2.12
MK-2010-A-26	1.46721	0.00002	0.05762	0.00065	0.281844	0.000011	0.001172	0.000009	1.608	0.281808	0.000022	1.7	0.8	1.96	2.17
MK-2010-A-27	1.46729	0.00004	0.03109	0.00290	0.282174	0.000016	0.000598	0.000046	1.187	0.282161	0.000032	4.6	1.1	1.49	1.67
MK-2010-A-29	1.46725	0.00004	0.07041	0.00400	0.282152	0.000020	0.001670	0.000170	1.115	0.282117	0.000040	1.4	1.4	1.56	1.81
MK-2010-A-30	1.46722	0.00002	0.03545	0.00046	0.282140	0.000010	0.000670	0.000005	1.138	0.282126	0.000020	2.2	0.7	1.54	1.78
MK-2010-A-31	1.46726	0.00005	0.09597	0.01200	0.281970	0.000016	0.002543	0.000360	1.535	0.281896	0.000032	3.1	1.1	1.86	2.03
MK-2010-A-32	1.46718	0.00004	0.05458	0.00210	0.281892	0.000018	0.001492	0.000120	1.440	0.281851	0.000036	-0.6	1.3	1.91	2.18
MK-2010-A-33^{d}	1.46736	0.00004	0.03708	0.00210	0.282195	0.000014	0.000746	0.000032	1.049	0.282180	0.000028	2.1	1.0	1.46	1.71
MK-2010-A-34	1.46735	0.00003	0.06278	0.00140	0.282021	0.000015	0.001184	0.000020	1.401	0.281990	0.000030	3.4	1.1	1.72	1.91
MK-2010-A-35	1.46725	0.00003	0.04156	0.00077	0.282214	0.000011	0.000745	0.000012	0.940	0.282201	0.000022	0.4	0.8	1.44	1.74
MK-2010-A-36	1.46718	0.00003	0.02672	0.00052	0.281625	0.000012	0.000555	0.000008	1.786	0.281606	0.000024	-1.4	0.9	2.23	2.50
MK-2010-A-37^{d}	1.46727	0.00004	0.04447	0.00210	0.281855	0.000017	0.001000	0.000045	1.385	0.281829	0.000034	-2.7	1.2	1.94	2.27

Notes: ∗) Reported ages are the $^{206}Pb/^{238}U$ ages if younger than or equal to 0.6 Ga, otherwise the $^{206}Pb/^{207}Pb$ ages are used. †) Initial $^{176}Hf/^{177}Hf$ value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a $^{176}Lu/^{177}Hf$ ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.

Table 11: Lu-Hf data for MK-2010-3

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-3-1	1.46724	0.00003	0.04018	0.00300	0.282227	0.000009	0.000907	0.000048	0.950	0.282211	0.000018	1.0	0.6	1.43	1.71
MK-2010-3-2	1.46721	0.00003	0.01843	0.00036	0.282140	0.000009	0.000451	0.000007	0.968	0.282132	0.000019	-1.4	0.7	1.53	1.87
MK-2010-3-3	1.46728	0.00003	0.03795	0.00063	0.281714	0.000011	0.000987	0.000010	1.483	0.281686	0.000022	-5.5	0.8	2.13	2.51

Table 11 (continued)

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-3-3	1.46720	0.00004	0.02146	0.00081	0.282028	0.000017	0.000660	0.000043	1.483	0.282009	0.000034	6.0	1.2	1.69	1.81
MK-2010-3-5	1.46734	0.00003	0.03808	0.00067	0.282127	0.000015	0.000851	0.000007	1.112	0.282109	0.000030	1.0	1.1	1.56	1.83
MK-2010-3-6	1.46728	0.00002	0.01940	0.00022	0.281921	0.000010	0.000494	0.000016	1.551	0.281906	0.000020	3.9	0.7	1.83	1.99
MK-2010-3-7	1.46727	0.00005	0.04536	0.00170	0.281951	0.000013	0.001083	0.000021	1.084	0.281929	0.000026	-6.0	0.9	1.81	2.24
MK-2010-3-9	1.46728	0.00005	0.05694	0.00150	0.282168	0.000026	0.001647	0.000110	0.587	0.282150	0.000052	-9.4	1.8	1.54	2.06
MK-2010-3-10	1.46720	0.00003	0.05229	0.00150	0.281657	0.000013	0.001491	0.000110	1.606	0.281612	0.000026	-5.3	0.9	2.24	2.60
MK-2010-3-11	1.46719	0.00004	0.02956	0.00120	0.281663	0.000017	0.000870	0.000068	1.752	0.281634	0.000034	-1.2	1.2	2.20	2.46
MK-2010-3-12	1.46727	0.00006	0.05224	0.00150	0.282741	0.000031	0.001926	0.000130	0.362	0.282728	0.000062	6.0	2.2	0.73	0.94
MK-2010-3-13	1.46721	0.00003	0.05257	0.00028	0.281794	0.000013	0.001372	0.000019	1.638	0.281751	0.000026	0.3	0.9	2.04	2.28
MK-2010-3-15	1.46729	0.00004	0.06761	0.00037	0.281870	0.000013	0.001808	0.000019	1.491	0.281819	0.000026	-0.6	0.9	1.96	2.22
MK-2010-3-17	1.46728	0.00003	0.03915	0.00060	0.281729	0.000013	0.001190	0.000036	1.647	0.281692	0.000026	-1.6	0.9	2.12	2.40
MK-2010-3-18	1.46725	0.00005	0.04120	0.00066	0.281952	0.000017	0.001125	0.000020	1.285	0.281925	0.000034	-1.6	1.2	1.81	2.12
MK-2010-3-19	1.46725	0.00004	0.00567	0.00057	0.282045	0.000018	0.000144	0.000020	0.993	0.282042	0.000036	-4.0	1.3	1.64	2.05
MK-2010-3-20[d]	1.46724	0.00003	0.06170	0.00100	0.281873	0.000014	0.001652	0.000039	1.620	0.281822	0.000028	2.5	1.0	1.95	2.13
MK-2010-3-21	1.46726	0.00005	0.04794	0.00140	0.282415	0.000022	0.001479	0.000079	0.672	0.282396	0.000044	1.3	1.6	1.19	1.47
MK-2010-3-22	1.46716	0.00005	0.06744	0.00250	0.281790	0.000020	0.002048	0.000150	0.600	0.281767	0.000040	-22.6	1.4	2.09	2.88
MK-2010-3-23	1.46728	0.00005	0.03457	0.00084	0.281993	0.000019	0.000904	0.000011	1.612	0.281965	0.000038	7.3	1.3	1.75	1.83
MK-2010-3-24	1.46722	0.00003	0.04081	0.00059	0.282169	0.000010	0.001102	0.000051	1.250	0.282143	0.000020	5.4	0.7	1.51	1.67
MK-2010-3-25	1.46721	0.00004	0.07115	0.00089	0.281851	0.000022	0.001891	0.000049	1.679	0.281791	0.000044	2.7	1.6	1.99	2.16
MK-2010-3-26	1.46725	0.00003	0.02528	0.00044	0.282654	0.000014	0.000658	0.000005	0.379	0.282649	0.000028	3.6	1.0	0.83	1.10
MK-2010-3-27	1.46715	0.00004	0.01993	0.00031	0.282182	0.000014	0.000463	0.000014	1.112	0.282172	0.000028	3.3	1.0	1.47	1.69
MK-2010-3-28	1.46729	0.00002	0.00460	0.00088	0.282331	0.000008	0.000151	0.000034	1.023	0.282328	0.000016	6.8	0.6	1.26	1.41
MK-2010-3-29	1.46725	0.00005	0.02355	0.00062	0.281921	0.000018	0.000824	0.000057	1.468	0.281898	0.000036	1.7	1.3	1.84	2.06
MK-2010-3-30	1.46721	0.00003	0.01542	0.00034	0.282120	0.000011	0.000398	0.000002	0.972	0.282113	0.000022	-2.0	0.8	1.55	1.91
MK-2010-3-31	1.46723	0.00002	0.03199	0.00072	0.282144	0.000010	0.000763	0.000008	1.121	0.282128	0.000020	1.9	0.7	1.54	1.78
MK-2010-3-32[d]	1.46726	0.00003	0.03709	0.00049	0.281857	0.000012	0.000978	0.000016	1.391	0.281831	0.000024	-2.5	0.9	1.94	2.26
MK-2010-3-33	1.46724	0.00003	0.09175	0.00400	0.282481	0.000021	0.002823	0.000210	0.363	0.282462	0.000042	-3.4	1.5	1.13	1.52
MK-2010-3-34a	1.46722	0.00003	0.03139	0.00100	0.282609	0.000011	0.000851	0.000057	0.324	0.282604	0.000022	0.8	0.8	0.90	1.24
MK-2010-3-34b	1.46720	0.00005	0.03739	0.00070	0.282579	0.000021	0.001211	0.000063	0.331	0.282571	0.000042	-0.2	1.5	0.95	1.30
MK-2010-3-35	1.46726	0.00003	0.04550	0.00120	0.282224	0.000011	0.001138	0.000027	1.212	0.282198	0.000022	6.5	0.8	1.44	1.57
MK-2010-3-36	1.46730	0.00003	0.02502	0.00033	0.281285	0.000011	0.000631	0.000012	1.847	0.281263	0.000022	-12.2	0.8	2.69	3.19
MK-2010-3-37	1.46729	0.00005	0.08028	0.00150	0.282039	0.000025	0.001934	0.000059	1.534	0.281983	0.000050	6.2	1.8	1.73	1.84
MK-2010-3-38	1.46729	0.00005	0.05986	0.00190	0.282144	0.000022	0.001932	0.000096	0.944	0.282110	0.000044	-2.8	1.6	1.58	1.93
MK-2010-3-40b	1.46723	0.00002	0.02697	0.00096	0.281945	0.000011	0.000692	0.000016	0.987	0.281932	0.000022	-8.1	0.8	1.80	2.29
MK-2010-3-40a	1.46728	0.00002	0.02268	0.00082	0.281972	0.000008	0.000632	0.000019	0.904	0.281961	0.000015	-8.9	0.5	1.76	2.28
MK-2010-3-41	1.46725	0.00004	0.02022	0.00048	0.282251	0.000012	0.000517	0.000013	0.953	0.282242	0.000024	2.1	0.9	1.38	1.64
MK-2010-3-42	1.46721	0.00004	0.04368	0.00180	0.282143	0.000011	0.001283	0.000094	1.085	0.282117	0.000022	0.7	0.8	1.56	1.83
MK-2010-3-43	1.46724	0.00003	0.01419	0.00070	0.281711	0.000013	0.000464	0.000035	1.536	0.281698	0.000026	-3.9	0.9	2.11	2.45
MK-2010-3-44	1.46738	0.00005	0.01931	0.00053	0.281201	0.000014	0.000762	0.000033	2.243	0.281168	0.000028	-6.4	1.0	2.81	3.15
MK-2010-3-45	1.46723	0.00004	0.01706	0.00067	0.282093	0.000012	0.000491	0.000034	1.271	0.282081	0.000024	3.7	0.9	1.59	1.79
MK-2010-3-47	1.46722	0.00004	0.02910	0.00160	0.282335	0.000027	0.000816	0.000012	1.143	0.282317	0.000054	9.1	1.9	1.27	1.35
MK-2010-3-48	1.46725	0.00003	0.01819	0.00062	0.282590	0.000013	0.000558	0.000018	0.753	0.282582	0.000026	9.7	0.9	0.92	1.02
MK-2010-3-49	1.46729	0.00004	0.03656	0.00230	0.282513	0.000015	0.001173	0.000120	0.330	0.282506	0.000030	-2.5	1.1	1.04	1.45

Table 11 (continued)

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-3-50	1.46719	0.00006	0.02551	0.00065	0.281635	0.000012	0.000950	0.000032	1.806	0.281602	0.000024	-1.1	0.9	2.24	2.49
MK-2010-3-51	1.46718	0.00004	0.04011	0.00170	0.282497	0.000011	0.001339	0.000100	0.355	0.282488	0.000022	-2.6	0.8	1.07	1.47
MK-2010-3-52[d]	1.46717	0.00002	0.05291	0.00240	0.282371	0.000012	0.001315	0.000065	0.338	0.282363	0.000024	-7.4	0.8	1.24	1.75
MK-2010-3-53[d]	1.46718	0.00003	0.05503	0.00220	0.282366	0.000011	0.001503	0.000031	0.483	0.282352	0.000022	-4.5	0.8	1.25	1.69
MK-2010-3-54	1.46721	0.00004	0.02733	0.00140	0.281842	0.000012	0.000771	0.000037	1.495	0.281820	0.000024	-0.5	0.9	1.95	2.22
MK-2010-3-55	1.46722	0.00003	0.04414	0.00270	0.282437	0.000013	0.001298	0.000120	0.342	0.282429	0.000026	-5.0	0.9	1.15	1.61
MK-2010-3-56	1.46727	0.00003	0.02146	0.00150	0.282171	0.000009	0.000528	0.000030	1.223	0.282159	0.000018	5.3	0.6	1.49	1.65
MK-2010-3-57	1.46729	0.00003	0.02203	0.00044	0.282084	0.000013	0.000551	0.000007	0.956	0.282074	0.000026	-3.8	0.9	1.61	2.00
MK-2010-3-58	1.46725	0.00003	0.02664	0.00051	0.282384	0.000011	0.000672	0.000011	0.359	0.282379	0.000022	-6.4	0.8	1.20	1.70
MK-2010-3-59	1.46719	0.00003	0.05807	0.00220	0.281790	0.000010	0.001580	0.000042	1.722	0.281738	0.000020	1.8	0.7	2.06	2.25
MK-2010-3-60	1.46722	0.00003	0.03542	0.00110	0.282243	0.000012	0.000886	0.000038	1.159	0.282224	0.000024	6.2	0.9	1.40	1.55
MK-2010-3-61	1.46720	0.00003	0.03205	0.00054	0.281859	0.000012	0.000843	0.000008	1.493	0.281835	0.000024	0.0	0.9	1.93	2.18
MK-2010-3-62	1.46719	0.00003	0.02503	0.00043	0.282236	0.000011	0.000646	0.000006	1.121	0.282222	0.000022	5.2	0.8	1.40	1.58
MK-2010-3-63	1.46725	0.00003	0.03511	0.00040	0.282296	0.000009	0.000923	0.000010	1.067	0.282277	0.000018	6.0	0.6	1.33	1.49
MK-2010-3-64	1.46722	0.00005	0.06077	0.00079	0.282334	0.000023	0.001939	0.000088	0.456	0.282317	0.000046	-6.4	1.6	1.31	1.78
MK-2010-3-65	1.46729	0.00003	0.02485	0.00023	0.282223	0.000011	0.000591	0.000008	1.028	0.282212	0.000022	2.8	0.8	1.42	1.66
MK-2010-3-66	1.46727	0.00004	0.01125	0.00027	0.282084	0.000012	0.000295	0.000008	0.985	0.282079	0.000024	-2.9	0.9	1.60	1.97
MK-2010-3-67	1.46732	0.00004	0.05392	0.00170	0.282225	0.000015	0.001490	0.000096	1.021	0.282196	0.000030	2.1	1.1	1.45	1.69
MK-2010-3-68	1.46723	0.00002	0.01506	0.00059	0.282171	0.000014	0.000436	0.000016	0.967	0.282163	0.000028	-0.3	1.0	1.49	1.80
MK-2010-3-69	1.46720	0.00003	0.02001	0.00082	0.282058	0.000012	0.000523	0.000027	1.038	0.282048	0.000024	-2.8	0.9	1.64	2.01
MK-2010-3-70	1.46725	0.00005	0.03810	0.00220	0.282519	0.000023	0.001128	0.000082	0.508	0.282508	0.000046	1.5	1.6	1.03	1.33
MK-2010-3-71	1.46724	0.00004	0.05606	0.00076	0.282509	0.000017	0.002000	0.000081	0.352	0.282496	0.000034	-2.4	1.2	1.07	1.45
MK-2010-3-72	1.46724	0.00006	0.03002	0.00015	0.281992	0.000018	0.001007	0.000024	1.029	0.281972	0.000036	-5.7	1.3	1.75	2.18
MK-2010-3-73	1.46730	0.00006	0.03968	0.00076	0.281857	0.000014	0.001247	0.000058	1.471	0.281822	0.000028	-1.0	1.0	1.95	2.23
MK-2010-3-74	1.46726	0.00003	0.04736	0.00140	0.282540	0.000016	0.001280	0.000017	0.440	0.282529	0.000032	0.8	1.1	1.00	1.33
MK-2010-3-75	1.46723	0.00004	0.01723	0.00027	0.281795	0.000011	0.000459	0.000007	1.505	0.281782	0.000022	-1.6	0.8	1.99	2.29
MK-2010-A-38	1.46734	0.00003	0.08875	0.00670	0.282423	0.000014	0.001565	0.000100	0.550	0.282407	0.000028	-1.1	1.0	1.18	1.53
MK-2010-A-39[d]	1.46724	0.00002	0.02486	0.00160	0.281348	0.000015	0.000598	0.000063	2.318	0.281322	0.000030	0.8	1.1	2.60	2.77
MK-2010-A-40	1.46728	0.00003	0.02234	0.00043	0.282110	0.000016	0.000452	0.000025	1.115	0.282100	0.000032	0.8	1.1	1.57	1.84
MK-2010-A-41	1.46727	0.00003	0.04335	0.00045	0.282022	0.000013	0.000838	0.000027	0.600	0.282013	0.000026	-13.9	0.9	1.71	2.35
MK-2010-A-42	1.46726	0.00003	0.07540	0.00120	0.282159	0.000018	0.001545	0.000087	0.906	0.282133	0.000036	-2.8	1.3	1.55	1.90
MK-2010-A-43	1.46726	0.00004	0.07354	0.00200	0.281997	0.000025	0.001663	0.000120	1.504	0.281950	0.000050	4.3	1.8	1.78	1.93
MK-2010-A-44	1.46721	0.00004	0.07133	0.00220	0.281873	0.000016	0.002092	0.000130	1.666	0.281807	0.000032	3.0	1.1	1.97	2.14
MK-2010-A-45	1.46721	0.00003	0.04273	0.00430	0.282234	0.000016	0.001123	0.000160	1.024	0.282212	0.000032	2.7	1.1	1.43	1.66
MK-2010-A-46	1.46723	0.00003	0.07826	0.00100	0.281942	0.000013	0.001403	0.000010	1.462	0.281903	0.000026	1.7	0.9	1.84	2.06
MK-2010-A-47	1.46724	0.00003	0.03673	0.00140	0.282508	0.000013	0.000740	0.000020	0.354	0.282503	0.000026	-2.1	0.9	1.03	1.44
MK-2010-A-49[d]	1.46718	0.00004	0.06834	0.00200	0.281465	0.000014	0.001433	0.000120	1.837	0.281415	0.000028	-7.0	1.0	2.50	2.87
MK-2010-A-50	1.46722	0.00003	0.03259	0.00130	0.281374	0.000013	0.000715	0.000019	1.796	0.281350	0.000026	-10.3	0.9	2.58	3.04
MK-2010-A-51	1.46725	0.00003	0.05205	0.00180	0.282175	0.000014	0.000924	0.000040	0.650	0.282164	0.000028	-7.5	1.0	1.50	1.99
MK-2010-A-53	1.46723	0.00004	0.02555	0.00130	0.282132	0.000013	0.000704	0.000024	1.011	0.282119	0.000026	-0.9	0.9	1.55	1.87
MK-2010-A-54	1.46729	0.00003	0.03285	0.00100	0.282492	0.000018	0.000791	0.000066	0.341	0.282487	0.000036	-3.0	1.3	1.06	1.48
MK-2010-A-55[d]	1.46723	0.00004	0.06926	0.00300	0.282019	0.000017	0.001726	0.000160	1.441	0.281972	0.000034	3.7	1.2	1.75	1.92
MK-2010-A-56	1.46730	0.00003	0.03632	0.00220	0.282486	0.000012	0.000847	0.000031	0.445	0.282479	0.000024	-0.9	0.8	1.07	1.43

Table 11 (continued)

	Measured ratios														
Name	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^C_{DM} (Ga)¶
MK-2010-A-57	1.46720	0.00003	0.04038	0.00083	0.282701	0.000017	0.001167	0.000036	0.602	0.282688	0.000034	10.0	1.2	0.78	0.88
MK-2010-A-58[d]	1.46726	0.00003	0.13925	0.00610	0.282343	0.000032	0.003562	0.000230	0.410	0.282316	0.000064	-7.5	2.3	1.36	1.81
MK-2010-A-60	1.46728	0.00004	0.04889	0.00140	0.281967	0.000018	0.001025	0.000079	1.517	0.281938	0.000036	4.2	1.3	1.79	1.95
MK-2010-A-61	1.46716	0.00008	0.06594	0.00120	0.281996	0.000035	0.002080	0.000041	0.983	0.281957	0.000070	-7.3	2.5	1.80	2.24
MK-2010-A-62	1.46722	0.00002	0.09219	0.00330	0.282522	0.000017	0.001833	0.000065	0.502	0.282505	0.000034	1.3	1.2	1.04	1.34
MK-2010-A-63	1.46725	0.00003	0.08742	0.00110	0.281814	0.000016	0.001804	0.000080	1.639	0.281758	0.000032	0.6	1.1	2.04	2.26
MK-2010-A-64	1.46724	0.00003	0.05621	0.00090	0.282732	0.000013	0.001598	0.000060	0.355	0.282721	0.000026	5.7	0.9	0.74	0.96
MK-2010-A-65	1.46731	0.00003	0.04618	0.00170	0.282022	0.000011	0.001333	0.000087	0.780	0.282002	0.000022	-10.3	0.8	1.73	2.26
MK-2010-A-66	1.46722	0.00003	0.02336	0.00026	0.282202	0.000013	0.000408	0.000004	1.031	0.282194	0.000026	2.2	0.9	1.44	1.69
MK-2010-A-67	1.46724	0.00003	0.04563	0.00093	0.281967	0.000014	0.000926	0.000037	1.318	0.281944	0.000028	-0.1	1.0	1.78	2.06
MK-2010-A-68[d]	1.46730	0.00003	0.09296	0.00460	0.282125	0.000031	0.001860	0.000180	1.818	0.282061	0.000062	15.5	2.2	1.61	1.49
MK-2010-A-69	1.46723	0.00003	0.04046	0.00023	0.282116	0.000011	0.000782	0.000011	1.387	0.282095	0.000022	6.8	0.8	1.57	1.69
MK-2010-A-70	1.46726	0.00003	0.05805	0.00045	0.281849	0.000012	0.001289	0.000058	1.695	0.281808	0.000024	3.7	0.9	1.96	2.12
MK-2010-A-71	1.46722	0.00003	0.05389	0.00240	0.282473	0.000022	0.001509	0.000110	0.568	0.282457	0.000044	1.1	1.6	1.10	1.41
MK-2010-A-72	1.46728	0.00004	0.07436	0.00140	0.281824	0.000007	0.001524	0.000055	1.678	0.281776	0.000015	2.1	0.5	2.01	2.20
MK-2010-A-73	1.46727	0.00002	0.05243	0.00042	0.281835	0.000010	0.001039	0.000046	1.588	0.281804	0.000020	1.1	0.7	1.97	2.19
MK-2010-A-74	1.46724	0.00003	0.14284	0.00250	0.282191	0.000015	0.002486	0.000027	0.948	0.282147	0.000030	-1.4	1.1	1.54	1.85
MK-2010-A-75	1.46729	0.00003	0.02898	0.00016	0.282695	0.000013	0.000541	0.000007	0.388	0.282691	0.000026	5.3	0.9	0.77	1.00
MK-2010-A-76	1.46723	0.00004	0.03608	0.00130	0.282280	0.000017	0.000934	0.000083	0.630	0.282269	0.000034	-4.2	1.2	1.35	1.78

Notes: ∗) Reported ages are the $^{206}Pb/^{238}U$ ages if younger than or equal to 0.6 Ga, otherwise the $^{206}Pb/^{207}Pb$ ages are used. †) Initial $^{176}Hf/^{177}Hf$ value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a $^{176}Lu/^{177}Hf$ ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.

Table 12: Lu-Hf data for MK-2010-4

	Measured ratios														
Name	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^C_{DM} (Ga)¶
MK-2010-4-1	1.46724	0.00004	0.05463	0.00190	0.282257	0.000018	0.001706	0.000097	0.981	0.282225	0.000036	2.2	1.3	1.41	1.66
MK-2010-4-2	1.46725	0.00003	0.04897	0.00083	0.281969	0.000012	0.001122	0.000021	1.483	0.281938	0.000024	3.4	0.9	1.79	1.97
MK-2010-4-3	1.46735	0.00003	0.04068	0.00036	0.281895	0.000012	0.000950	0.000026	1.495	0.281868	0.000024	1.2	0.9	1.88	2.11
MK-2010-4-4	1.46717	0.00005	0.02999	0.00110	0.282299	0.000020	0.001134	0.000083	1.044	0.282277	0.000040	5.4	1.4	1.34	1.50
MK-2010-4-5	1.46729	0.00003	0.02947	0.00032	0.281927	0.000014	0.000684	0.000005	1.440	0.281908	0.000028	1.4	1.0	1.83	2.06
MK-2010-4-6	1.46721	0.00004	0.01765	0.00110	0.281942	0.000017	0.000652	0.000084	1.110	0.281928	0.000034	-5.4	1.2	1.81	2.22
MK-2010-4-7	1.46719	0.00004	0.05638	0.00130	0.282340	0.000030	0.001773	0.000095	0.440	0.282325	0.000060	-6.5	2.1	1.30	1.77
MK-2010-4-8	1.46727	0.00004	0.02573	0.00077	0.282120	0.000015	0.000758	0.000057	1.040	0.282105	0.000030	-0.7	1.1	1.57	1.88
MK-2010-4-9	1.46720	0.00003	0.03276	0.00094	0.281760	0.000016	0.000741	0.000051	1.541	0.281738	0.000032	-2.3	1.1	2.06	2.36
MK-2010-4-10	1.46740	0.00006	0.10002	0.00180	0.281986	0.000024	0.002193	0.000030	1.618	0.281919	0.000048	5.8	1.7	1.82	1.93

Table 12 (continued)

Name	Measured ratios $^{178}Hf/^{177}Hf$	1σ	$^{177}Yb/^{177}Hf$	1σ	$^{176}Hf/^{177}Hf$	1σ	$^{176}Lu/^{177}Hf$	1σ	Age (Ga)*	$^{176}Hf/^{177}Hf(t)$†	2σ	$\varepsilon_{Hf}(t)$‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-4-12	1.46725	0.00003	0.07811	0.00240	0.282227	0.000014	0.001824	0.000081	1.038	0.282191	0.000028	2.3	1.0	1.46	1.69
MK-2010-4-13	1.46725	0.00005	0.04173	0.00190	0.281646	0.000015	0.001255	0.000120	1.787	0.281603	0.000030	-1.5	1.1	2.24	2.50
MK-2010-4-14	1.46716	0.00004	0.04651	0.00090	0.281895	0.000019	0.001441	0.000095	1.590	0.281852	0.000038	2.8	1.3	1.91	2.09
MK-2010-4-15	1.46716	0.00007	0.05208	0.00099	0.282093	0.000025	0.001906	0.000082	1.034	0.282056	0.000050	-2.6	1.8	1.65	1.99
MK-2010-4-16	1.46727	0.00005	0.02837	0.00051	0.282211	0.000013	0.000560	0.000004	1.051	0.282200	0.000026	2.9	0.9	1.44	1.67
MK-2010-4-17	1.46721	0.00002	0.05184	0.00180	0.281934	0.000014	0.001188	0.000059	1.180	0.281908	0.000028	-4.6	1.0	1.84	2.22
MK-2010-4-18	1.46721	0.00005	0.06641	0.00180	0.282236	0.000014	0.001749	0.000100	1.041	0.282202	0.000028	2.7	1.0	1.45	1.67
MK-2010-4-19	1.46724	0.00004	0.02586	0.00220	0.282283	0.000018	0.000631	0.000019	0.886	0.282272	0.000036	1.7	1.3	1.34	1.61
MK-2010-4-20	1.46723	0.00003	0.03534	0.00027	0.281934	0.000014	0.000748	0.000011	1.398	0.281914	0.000028	0.6	1.0	1.82	2.07
MK-2010-4-21	1.46731	0.00004	0.04588	0.00170	0.282104	0.000013	0.000967	0.000024	0.968	0.282086	0.000026	-3.0	0.9	1.60	1.97
MK-2010-4-22	1.46719	0.00005	0.04531	0.00048	0.282224	0.000018	0.001335	0.000074	1.032	0.282198	0.000036	2.4	1.3	1.45	1.68
MK-2010-4-23[d]	1.46715	0.00003	0.02761	0.00084	0.281048	0.000014	0.000571	0.000015	2.679	0.281019	0.000028	-1.5	1.0	3.00	3.19
MK-2010-4-24	1.46722	0.00003	0.04054	0.00099	0.282246	0.000013	0.000807	0.000013	1.048	0.282230	0.000026	3.9	0.9	1.40	1.60
MK-2010-4-25	1.46726	0.00003	0.04569	0.00075	0.281953	0.000014	0.001085	0.000031	1.543	0.281921	0.000028	4.2	1.0	1.81	1.97
MK-2010-4-26	1.46730	0.00004	0.06727	0.00160	0.281935	0.000015	0.001818	0.000140	1.253	0.281892	0.000030	-3.5	1.1	1.87	2.21
MK-2010-4-27	1.46723	0.00002	0.01061	0.00032	0.282125	0.000011	0.000377	0.000022	1.056	0.282117	0.000022	0.1	0.8	1.55	1.84
MK-2010-4-28	1.46735	0.00004	0.08036	0.00130	0.282016	0.000020	0.002303	0.000120	1.260	0.281961	0.000040	-0.9	1.4	1.78	2.06
MK-2010-4-29	1.46729	0.00005	0.10983	0.00110	0.281986	0.000019	0.002383	0.000017	1.461	0.281920	0.000038	2.3	1.3	1.83	2.02
MK-2010-4-30	1.46727	0.00003	0.02716	0.00035	0.282153	0.000015	0.000566	0.000008	1.092	0.282141	0.000030	1.7	1.1	1.52	1.77
MK-2010-4-31	1.46722	0.00003	0.03564	0.00078	0.281972	0.000014	0.000821	0.000016	1.519	0.281948	0.000028	4.6	1.0	1.77	1.92
MK-2010-4-34	1.46721	0.00003	0.10145	0.00280	0.281934	0.000015	0.002343	0.000060	1.428	0.281871	0.000030	-0.2	1.1	1.90	2.15
MK-2010-4-35	1.46726	0.00003	0.02567	0.00088	0.281783	0.000009	0.000647	0.000022	1.649	0.281763	0.000018	1.0	0.6	2.02	2.24
MK-2010-4-37	1.46727	0.00004	0.04636	0.00084	0.281973	0.000016	0.001043	0.000014	1.483	0.281944	0.000032	3.6	1.1	1.78	1.96
MK-2010-4-38	1.46721	0.00003	0.02881	0.00018	0.282213	0.000016	0.000659	0.000018	1.038	0.282200	0.000032	2.6	1.1	1.44	1.68
MK-2010-4-39	1.46726	0.00004	0.02369	0.00044	0.282209	0.000012	0.000521	0.000012	1.031	0.282199	0.000024	2.4	0.9	1.44	1.68
MK-2010-4-40	1.46736	0.00003	0.04565	0.00092	0.281897	0.000015	0.001063	0.000018	1.600	0.281865	0.000030	3.5	1.1	1.89	2.05
MK-2010-4-41	1.46725	0.00003	0.02284	0.00026	0.282256	0.000016	0.000484	0.000008	0.946	0.282247	0.000032	2.2	1.1	1.37	1.63
MK-2010-4-42[d]	1.46723	0.00003	0.08841	0.00160	0.281939	0.000014	0.002169	0.000059	1.381	0.281882	0.000028	-0.9	1.0	1.88	2.15
MK-2010-4-43	1.46733	0.00004	0.03837	0.00110	0.281871	0.000014	0.000999	0.000029	1.654	0.281840	0.000028	3.8	1.0	1.92	2.07
MK-2010-4-44	1.46723	0.00005	0.04334	0.00280	0.282172	0.000018	0.001254	0.000140	1.039	0.282147	0.000036	0.7	1.3	1.52	1.79
MK-2010-4-45	1.46729	0.00006	0.03542	0.00074	0.281883	0.000020	0.000782	0.000019	1.612	0.281859	0.000040	3.6	1.4	1.89	2.06
MK-2010-4-48	1.46725	0.00004	0.03302	0.00035	0.282217	0.000013	0.000735	0.000024	1.091	0.282202	0.000026	3.8	0.9	1.43	1.64
MK-2010-4-49	1.46725	0.00004	0.04455	0.00150	0.281861	0.000011	0.001303	0.000083	1.639	0.281821	0.000022	2.8	0.8	1.95	2.13
MK-2010-4-50	1.46720	0.00003	0.06054	0.00100	0.281800	0.000014	0.001545	0.000062	1.681	0.281751	0.000028	1.3	1.0	2.05	2.25
MK-2010-4-53	1.46719	0.00004	0.04471	0.00120	0.281970	0.000012	0.001040	0.000034	1.463	0.281941	0.000024	3.1	0.9	1.79	1.97
MK-2010-4-54	1.46731	0.00004	0.02381	0.00037	0.282211	0.000012	0.000659	0.000030	1.026	0.282198	0.000024	2.2	0.9	1.44	1.69
MK-2010-4-56	1.46733	0.00003	0.02888	0.00130	0.282242	0.000015	0.000614	0.000024	0.927	0.282231	0.000030	1.2	1.1	1.40	1.68
MK-2010-4-57	1.46724	0.00003	0.03898	0.00150	0.281593	0.000015	0.000999	0.000030	1.816	0.281559	0.000030	-2.4	1.1	2.30	2.58
MK-2010-4-59	1.46717	0.00004	0.04319	0.00130	0.281954	0.000016	0.001197	0.000088	1.501	0.281920	0.000032	3.2	1.1	1.81	2.00
MK-2010-4-60[d]	1.46725	0.00003	0.03232	0.00048	0.281092	0.000016	0.000777	0.000011	0.488	0.281085	0.000032	-49.3	1.1	2.96	4.38
MK-2010-4-61	1.46727	0.00004	0.01802	0.00039	0.282181	0.000013	0.000369	0.000009	1.352	0.282172	0.000026	8.7	0.9	1.47	1.54
MK-2010-4-62	1.46731	0.00004	0.04557	0.00037	0.281901	0.000015	0.001157	0.000051	1.488	0.281868	0.000030	1.1	1.1	1.89	2.12
MK-2010-4-63	1.46733	0.00002	0.01321	0.00089	0.281965	0.000013	0.000358	0.000019	1.450	0.281955	0.000026	3.3	0.9	1.76	1.95

Table 12 (continued)

Name	Measured ratios								Age (Ga)*	$\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
	$\frac{^{178}\mathrm{Hf}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{177}\mathrm{Yb}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{176}\mathrm{Hf}}{^{177}\mathrm{Hf}}$	1σ	$\frac{^{176}\mathrm{Lu}}{^{177}\mathrm{Hf}}$	1σ							
MK-2010-4-64[d]	1.46724	0.00002	0.08442	0.00830	0.281705	0.000012	0.001639	0.000120	1.418	0.281661	0.000024	-7.9	0.9	2.18	2.61
MK-2010-4-66	1.46717	0.00004	0.02683	0.00170	0.281872	0.000013	0.000739	0.000044	1.606	0.281849	0.000026	3.1	0.9	1.90	2.08
MK-2010-4-67	1.46724	0.00003	0.03906	0.00043	0.282215	0.000014	0.000939	0.000027	0.928	0.282199	0.000028	0.0	1.0	1.44	1.75
MK-2010-4-68[d]	1.46728	0.00005	0.03626	0.00210	0.281862	0.000019	0.001188	0.000110	1.112	0.281837	0.000038	-8.6	1.3	1.94	2.42
MK-2010-4-71	1.46731	0.00003	0.03491	0.00120	0.281908	0.000014	0.000931	0.000035	1.179	0.281887	0.000028	-5.3	1.0	1.87	2.27
MK-2010-4-72	1.46726	0.00002	0.01913	0.00020	0.282184	0.000011	0.000478	0.000006	1.037	0.282175	0.000022	1.6	0.8	1.47	1.73
MK-2010-A-77	1.46737	0.00003	0.03607	0.00021	0.282217	0.000013	0.000210	0.000619	1.109	0.282204	0.000026	4.3	0.9	1.41	1.62
MK-2010-A-78	1.46724	0.00003	0.03507	0.00180	0.281613	0.000013	0.001800	0.000655	1.800	0.281591	0.000026	-1.6	0.9	2.32	2.52
MK-2010-A-79	1.46722	0.00005	0.04839	0.00028	0.282171	0.000019	0.000280	0.000886	1.058	0.282153	0.000038	1.4	1.3	1.48	1.77
MK-2010-A-80	1.46725	0.00004	0.06683	0.00220	0.281992	0.000019	0.002200	0.001230	1.493	0.281957	0.000038	4.3	1.3	1.81	1.92
Mk-2010-A-81	1.46721	0.00003	0.05371	0.00045	0.281871	0.000012	0.000450	0.001102	1.601	0.281838	0.000024	2.6	0.9	1.89	2.11
MK-2010-A-82	1.46729	0.00004	0.03383	0.00035	0.282217	0.000014	0.000350	0.000618	1.044	0.282205	0.000028	2.9	1.0	1.42	1.66
MK-2010-A-83	1.46721	0.00003	0.02849	0.00036	0.282187	0.000012	0.000360	0.000516	0.962	0.282178	0.000024	0.1	0.9	1.46	1.77
MK-2010-A-84	1.46726	0.00003	0.14443	0.01200	0.281978	0.000018	0.012000	0.002638	1.589	0.281899	0.000036	4.4	1.3	2.48	1.99
MK-2010-A-85	1.46732	0.00004	0.04091	0.00051	0.282203	0.000011	0.000510	0.000709	1.026	0.282189	0.000022	1.9	0.8	1.44	1.71
MK-2010-A-86a	1.46723	0.00005	0.05694	0.00150	0.281955	0.000014	0.001500	0.001495	1.583	0.281910	0.000028	4.7	1.0	1.83	1.97
MK-2010-A-86b[d]	1.46722	0.00004	0.06766	0.00250	0.281809	0.000014	0.002500	0.001862	1.910	0.281741	0.000028	6.3	1.0	2.09	2.13
MK-2010-A-87	1.46728	0.00003	0.04486	0.00055	0.282224	0.000015	0.000550	0.000820	1.040	0.282208	0.000030	2.9	1.1	1.42	1.66
MK-2010-A-88	1.46731	0.00003	0.02719	0.00049	0.282245	0.000017	0.000490	0.000613	1.029	0.282233	0.000034	3.5	1.2	1.39	1.61
MK-2010-A-89	1.46726	0.00004	0.02865	0.00042	0.282214	0.000016	0.000420	0.000643	1.013	0.282202	0.000032	2.1	1.1	1.43	1.69
MK-2010-A-90	1.46727	0.00004	0.04301	0.00078	0.282165	0.000015	0.000832	0.000027	1.069	0.282148	0.000030	1.4	1.1	1.51	1.77
MK-2010-A-91	1.46728	0.00004	0.08487	0.00250	0.282491	0.000017	0.001409	0.000035	0.599	0.282475	0.000034	2.4	1.2	1.08	1.35
MK-2010-A-92	1.46729	0.00005	0.06221	0.00290	0.282474	0.000021	0.001866	0.000140	0.512	0.282456	0.000042	-0.2	1.5	1.11	1.44
MK-2010-A-94	1.46724	0.00004	0.04139	0.00140	0.282161	0.000014	0.001301	0.000050	1.046	0.282135	0.000028	0.5	1.0	1.53	1.81
MK-2010-A-95	1.46719	0.00005	0.04343	0.00160	0.281954	0.000017	0.001307	0.000100	1.415	0.281919	0.000034	1.2	1.2	1.82	2.05
MK-2010-A-96	1.46718	0.00004	0.04077	0.00150	0.282167	0.000012	0.001207	0.000081	1.041	0.282143	0.000024	0.6	0.9	1.52	1.80
MK-2010-A-97	1.46729	0.00003	0.02901	0.00064	0.282205	0.000015	0.000724	0.000056	1.052	0.282191	0.000030	2.6	1.1	1.45	1.69
MK-2010-A-98b	1.46735	0.00006	0.07018	0.00120	0.282111	0.000024	0.002286	0.000030	1.042	0.282066	0.000048	-2.1	1.7	1.65	1.96
MK-2010-A-98a	1.46724	0.00003	0.04380	0.00280	0.282222	0.000015	0.001278	0.000110	1.016	0.282198	0.000030	2.0	1.1	1.45	1.70
MK-2010-A-99a	1.46718	0.00003	0.03955	0.00140	0.282185	0.000011	0.000956	0.000096	1.043	0.282166	0.000022	1.5	0.8	1.49	1.75
MK-2010-A-99b	1.46722	0.00004	0.02083	0.00090	0.282182	0.000015	0.000535	0.000056	1.025	0.282172	0.000030	1.3	1.1	1.47	1.75
MK-2010-A-100	1.46722	0.00006	0.04608	0.00120	0.281886	0.000019	0.001300	0.000095	1.452	0.281850	0.000038	-0.4	1.3	1.91	2.18
MK-2010-A-101	1.46720	0.00003	0.05834	0.00100	0.281951	0.000014	0.001290	0.000014	1.459	0.281915	0.000028	2.1	1.0	1.82	2.03
MK-2010-A-102	1.46721	0.00002	0.03569	0.00150	0.282257	0.000010	0.000645	0.000020	0.958	0.282245	0.000020	2.4	0.7	1.38	1.63
MK-2010-A-103	1.46720	0.00002	0.05459	0.01100	0.282206	0.000012	0.001068	0.000190	1.071	0.282184	0.000024	2.8	0.9	1.46	1.69
MK-2010-A-105	1.46715	0.00003	0.02785	0.00043	0.282228	0.000012	0.000521	0.000005	0.935	0.282219	0.000024	0.9	0.9	1.41	1.70
MK-2010-A-106	1.46724	0.00003	0.06222	0.00082	0.282267	0.000012	0.001196	0.000020	0.505	0.282256	0.000024	-7.5	0.8	1.38	1.88
MK-2010-A-107	1.46726	0.00003	0.03988	0.00051	0.282213	0.000010	0.000854	0.000026	1.046	0.282196	0.000020	2.6	0.7	1.44	1.68
MK-2010-A-108	1.46727	0.00003	0.10476	0.00220	0.282093	0.000015	0.002033	0.000110	1.280	0.282044	0.000030	2.5	1.1	1.66	1.87
MK-2010-A-109	1.46735	0.00003	0.04003	0.00110	0.282182	0.000013	0.000755	0.000017	1.024	0.282167	0.000026	1.1	0.9	1.48	1.76
MK-2010-A-110	1.46732	0.00003	0.02300	0.00022	0.282247	0.000013	0.000405	0.000005	1.045	0.282239	0.000026	4.1	0.9	1.38	1.59
MK-2010-A-111	1.46735	0.00003	0.06715	0.00069	0.281927	0.000011	0.001354	0.000035	1.467	0.281889	0.000022	1.3	0.8	1.86	2.08

Table 12 (continued)

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-A-112	1.46732	0.00004	0.07970	0.00280	0.282108	0.000015	0.002310	0.000150	1.194	0.282056	0.000030	1.0	1.1	1.65	1.89

Notes: ∗) Reported ages are the $^{206}Pb/^{238}U$ ages if younger than or equal to 0.6 Ga, otherwise the $^{206}Pb/^{207}Pb$ ages are used. †) Initial $^{176}Hf/^{177}Hf$ value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a $^{176}Lu/^{177}Hf$ ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.

Table 13: Lu-Hf data for MK-2010-5

Name	Measured ratios $\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-5-1^{d}	1.46721	0.00004	0.02549	0.00120	0.281358	0.000010	0.000635	0.000022	1.849	0.281336	0.000020	-9.6	0.7	2.59	3.03
MK-2010-5-2	1.46715	0.00003	0.07502	0.00062	0.282442	0.000018	0.002311	0.000062	0.596	0.282416	0.000036	0.3	1.3	1.17	1.48
MK-2010-5-3	1.46731	0.00007	0.03413	0.00095	0.282218	0.000027	0.000800	0.000056	1.036	0.282202	0.000054	2.6	1.9	1.44	1.67
MK-2010-5-4	1.46727	0.00010	0.04989	0.00077	0.282407	0.000033	0.001021	0.000021	0.447	0.282398	0.000066	-3.7	2.3	1.18	1.61
MK-2010-5-5	1.46729	0.00002	0.10008	0.00270	0.282156	0.000011	0.002104	0.000037	0.953	0.282118	0.000022	-2.3	0.8	1.57	1.91
MK-2010-5-7	1.46724	0.00002	0.01808	0.00059	0.282179	0.000012	0.000538	0.000007	1.033	0.282169	0.000024	1.3	0.9	1.48	1.75
MK-2010-5-8	1.46723	0.00004	0.02619	0.00072	0.282247	0.000017	0.000682	0.000055	1.030	0.282234	0.000034	3.6	1.2	1.39	1.61
MK-2010-5-9	1.46724	0.00003	0.02236	0.00023	0.282180	0.000012	0.000517	0.000004	1.064	0.282170	0.000024	2.1	0.9	1.48	1.73
MK-2010-5-11b	1.46729	0.00003	0.01563	0.00037	0.282169	0.000018	0.000458	0.000020	1.040	0.282160	0.000036	1.2	1.3	1.49	1.76
MK-2010-5-12	1.46720	0.00002	0.06148	0.00130	0.282083	0.000013	0.001418	0.000033	1.202	0.282051	0.000026	1.0	0.9	1.65	1.90
MK-2010-5-13	1.46727	0.00004	0.03489	0.00072	0.281909	0.000014	0.000852	0.000013	1.608	0.281883	0.000028	4.3	1.0	1.86	2.01
MK-2010-5-14	1.46724	0.00003	0.04168	0.00100	0.281925	0.000013	0.001215	0.000056	1.491	0.281891	0.000026	1.9	0.9	1.86	2.07
MK-2010-5-15	1.46728	0.00003	0.04248	0.00079	0.282110	0.000013	0.001114	0.000045	1.379	0.282081	0.000026	6.1	0.9	1.60	1.72
MK-2010-5-16	1.46726	0.00004	0.02497	0.00027	0.282230	0.000012	0.000564	0.000021	0.928	0.282220	0.000024	0.8	0.9	1.41	1.70
MK-2010-5-17	1.46734	0.00003	0.02230	0.00053	0.282028	0.000013	0.000491	0.000007	1.321	0.282016	0.000026	2.5	0.9	1.68	1.90
MK-2010-5-18	1.46722	0.00004	0.03243	0.00045	0.282179	0.000013	0.001008	0.000047	1.056	0.282159	0.000026	1.5	0.9	1.50	1.75
MK-2010-5-19	1.46722	0.00003	0.07429	0.00160	0.281555	0.000017	0.001768	0.000020	1.797	0.281495	0.000034	-5.1	1.2	2.40	2.73
MK-2010-5-21	1.46727	0.00004	0.03094	0.00140	0.282123	0.000019	0.001054	0.000067	1.185	0.282099	0.000038	2.3	1.3	1.58	1.80
MK-2010-5-24	1.46725	0.00003	0.02300	0.00076	0.282171	0.000013	0.000551	0.000007	1.039	0.282160	0.000026	1.2	0.9	1.49	1.76
MK-2010-5-26	1.46729	0.00003	0.01999	0.00089	0.282232	0.000015	0.000508	0.000023	0.926	0.282223	0.000030	0.9	1.1	1.41	1.70
MK-2010-5-27	1.46729	0.00003	0.02751	0.00067	0.282238	0.000017	0.000810	0.000053	1.039	0.282222	0.000034	3.4	1.2	1.41	1.63
MK-2010-5-29	1.46719	0.00004	0.02079	0.00081	0.281943	0.000011	0.000833	0.000050	1.490	0.281920	0.000022	2.9	0.8	1.81	2.00
MK-2010-5-30	1.46720	0.00003	0.02534	0.00058	0.282309	0.000015	0.000644	0.000044	0.967	0.282297	0.000030	4.4	1.1	1.30	1.51
MK-2010-5-32	1.46736	0.00003	0.06456	0.00270	0.282007	0.000013	0.001791	0.000057	1.202	0.281966	0.000026	-2.0	0.9	1.77	2.08
MK-2010-5-33	1.46736	0.00003	0.02859	0.00160	0.281679	0.000014	0.000705	0.000025	1.792	0.281655	0.000028	0.5	1.0	2.16	2.39
MK-2010-5-34	1.46727	0.00003	0.03575	0.00099	0.282199	0.000013	0.000953	0.000040	1.049	0.282180	0.000026	2.1	0.9	1.47	1.71
MK-2010-5-35	1.46718	0.00005	0.04429	0.00280	0.282215	0.000014	0.001364	0.000130	1.069	0.282188	0.000028	2.8	1.0	1.46	1.68
MK-2010-5-36	1.46726	0.00004	0.03349	0.00130	0.282199	0.000017	0.000941	0.000076	1.037	0.282181	0.000034	1.9	1.2	1.47	1.72

Table 13 (continued)

	Measured ratios														
Name	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-5-37	1.46724	0.00003	0.03122	0.00049	0.282175	0.000012	0.000954	0.000043	1.280	0.282152	0.000024	6.4	0.9	1.50	1.63
MK-2010-5-38	1.46717	0.00004	0.13112	0.00560	0.282088	0.000022	0.003035	0.000260	1.224	0.282018	0.000044	0.3	1.6	1.71	1.96
MK-2010-5-39	1.46720	0.00004	0.04622	0.00099	0.282023	0.000017	0.001548	0.000070	1.597	0.281976	0.000034	7.4	1.2	1.74	1.81
MK-2010-5-40	1.46726	0.00003	0.04012	0.00150	0.282295	0.000013	0.000996	0.000033	0.450	0.282287	0.000026	-7.6	0.9	1.34	1.85
MK-2010-5-41[d]	1.46731	0.00005	0.03027	0.00029	0.282053	0.000016	0.000777	0.000040	1.474	0.282031	0.000032	6.5	1.1	1.66	1.77
MK-2010-5-43	1.46738	0.00005	0.06212	0.00140	0.281920	0.000015	0.001586	0.000013	1.660	0.281870	0.000030	5.1	1.1	1.88	2.00
MK-2010-5-47	1.46722	0.00005	0.01734	0.00033	0.282199	0.000022	0.000359	0.000005	1.028	0.282192	0.000044	2.1	1.6	1.44	1.70
MK-2010-5-48	1.46731	0.00004	0.09229	0.00260	0.281877	0.000018	0.002107	0.000096	1.603	0.281813	0.000036	1.7	1.3	1.97	2.16
MK-2010-5-49	1.46728	0.00003	0.02965	0.00120	0.282004	0.000012	0.000734	0.000049	0.964	0.281991	0.000024	-6.5	0.9	1.73	2.18
MK-2010-5-50	1.46731	0.00006	0.03670	0.00020	0.282157	0.000017	0.000697	0.000004	1.030	0.282143	0.000034	0.4	1.2	1.51	1.80
MK-2010-5-51	1.46728	0.00003	0.06222	0.00270	0.282513	0.000014	0.001271	0.000066	0.437	0.282503	0.000028	-0.3	1.0	1.04	1.39
MK-2010-5-52	1.46721	0.00015	0.00900	0.00008	0.282383	0.000095	0.000370	0.000003	0.478	0.282380	0.000190	-3.7	6.7	1.19	1.63
MK-2010-5-53	1.46731	0.00004	0.03558	0.00097	0.282196	0.000013	0.000858	0.000044	1.030	0.282179	0.000026	1.7	0.9	1.47	1.73
MK-2010-5-54	1.46739	0.00003	0.03383	0.00060	0.281612	0.000017	0.000772	0.000037	1.826	0.281585	0.000034	-1.2	1.2	2.26	2.52
MK-2010-5-55	1.46726	0.00005	0.03817	0.00120	0.282280	0.000023	0.001313	0.000089	0.747	0.282262	0.000046	-1.8	1.6	1.37	1.72
MK-2010-5-56	1.46721	0.00003	0.05503	0.00055	0.282252	0.000009	0.001085	0.000010	1.158	0.282228	0.000019	6.3	0.7	1.40	1.54
MK-2010-5-57	1.46721	0.00004	0.04548	0.00069	0.281901	0.000014	0.001279	0.000076	1.632	0.281861	0.000028	4.1	1.0	1.89	2.04
MK-2010-5-58	1.46722	0.00004	0.04436	0.00110	0.281926	0.000011	0.001081	0.000064	1.503	0.281895	0.000022	2.4	0.8	1.85	2.05
MK-2010-5-59	1.46725	0.00002	0.04121	0.00370	0.282011	0.000009	0.000914	0.000057	1.507	0.281985	0.000018	5.6	0.6	1.72	1.85
MK-2010-5-61	1.46720	0.00005	0.04944	0.00110	0.281788	0.000019	0.001508	0.000070	1.654	0.281741	0.000038	0.3	1.3	2.06	2.29
MK-2010-A-115	1.46728	0.00005	0.03166	0.00076	0.282121	0.000016	0.000515	0.000013	1.066	0.282111	0.000032	0.0	1.1	1.56	1.85
MK-2010-A-116	1.46730	0.00005	0.14924	0.00240	0.281665	0.000015	0.002739	0.000071	1.785	0.281572	0.000030	-2.6	1.1	2.30	2.57
MK-2010-A-117	1.46723	0.00003	0.03437	0.00160	0.282212	0.000013	0.000588	0.000022	0.914	0.282202	0.000026	-0.2	0.9	1.44	1.75
MK-2010-A-118	1.46723	0.00006	0.05847	0.00093	0.281837	0.000017	0.001073	0.000037	1.646	0.281804	0.000034	2.4	1.2	1.97	2.16
MK-2010-A-119	1.46715	0.00004	0.01994	0.00034	0.282423	0.000013	0.000327	0.000004	0.462	0.282420	0.000026	-2.6	0.9	1.14	1.55
MK-2010-A-120	1.46719	0.00003	0.04100	0.00015	0.282195	0.000013	0.000716	0.000026	1.110	0.282180	0.000026	3.5	0.9	1.46	1.67
MK-2010-A-121	1.46727	0.00006	0.02937	0.00008	0.282200	0.000018	0.000488	0.000006	1.034	0.282190	0.000036	2.1	1.3	1.45	1.70
MK-2010-A-122	1.46728	0.00004	0.03495	0.00025	0.282104	0.000016	0.000610	0.000009	1.037	0.282092	0.000032	-1.3	1.1	1.58	1.91
MK-2010-A-125	1.46728	0.00004	0.06461	0.00170	0.281954	0.000020	0.001158	0.000021	1.792	0.281915	0.000040	9.7	1.4	1.81	1.83
MK-2010-A-126	1.46734	0.00003	0.13142	0.00470	0.281913	0.000015	0.002418	0.000084	1.666	0.281837	0.000030	4.0	1.1	1.93	2.07
MK-2010-A-127	1.46728	0.00004	0.03138	0.00040	0.282037	0.000016	0.000534	0.000003	1.432	0.282023	0.000032	5.2	1.1	1.67	1.82
MK-2010-A-128	1.46724	0.00005	0.03060	0.00076	0.282091	0.000023	0.000764	0.000056	1.047	0.282076	0.000046	-1.6	1.6	1.61	1.94
MK-2010-A-129[d]	1.46736	0.00004	0.16236	0.00510	0.282029	0.000020	0.002905	0.000095	1.611	0.281940	0.000040	6.4	1.4	1.79	1.88
MK-2010-A-130	1.46738	0.00007	0.05246	0.00180	0.282065	0.000028	0.001235	0.000031	0.952	0.282043	0.000056	-4.9	2.0	1.66	2.07
MK-2010-A-132	1.46727	0.00004	0.05850	0.00130	0.282317	0.000015	0.001119	0.000064	0.447	0.282308	0.000030	-6.9	1.1	1.31	1.81
MK-2010-A-134	1.46719	0.00007	0.03496	0.00036	0.281801	0.000024	0.000879	0.000051	1.717	0.281772	0.000048	2.9	1.7	2.01	2.18
MK-2010-A-135	1.46729	0.00003	0.03150	0.00022	0.282218	0.000015	0.000560	0.000003	1.042	0.282207	0.000030	2.9	1.1	1.43	1.66
MK-2010-A-136	1.46725	0.00004	0.03534	0.00019	0.282273	0.000013	0.000735	0.000011	1.035	0.282259	0.000026	4.6	0.9	1.36	1.55
MK-2010-A-137	1.46741	0.00006	0.03349	0.00025	0.282129	0.000020	0.000637	0.000003	1.048	0.282116	0.000040	-0.2	1.4	1.55	1.85
MK-2010-A-138	1.46723	0.00003	0.03345	0.00031	0.282182	0.000015	0.000605	0.000017	1.042	0.282170	0.000030	1.6	1.1	1.48	1.74
MK-2010-A-139	1.46721	0.00003	0.07078	0.00160	0.282238	0.000017	0.001511	0.000051	1.123	0.282206	0.000034	4.7	1.2	1.43	1.61
MK-2010-A-140	1.46720	0.00003	0.03396	0.00072	0.282178	0.000012	0.000635	0.000009	1.040	0.282166	0.000024	1.4	0.9	1.48	1.75
MK-2010-A-141	1.46719	0.00009	0.03468	0.00067	0.282089	0.000034	0.001097	0.000024	1.039	0.282068	0.000068	-2.1	2.4	1.62	1.96

Table 13 (continued)

	Measured ratios														
Name	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-A-142	1.46726	0.00003	0.07912	0.00075	0.282156	0.000012	0.001687	0.000019	1.520	0.282107	0.000024	10.3	0.9	1.56	1.58
MK-2010-A-143	1.46728	0.00003	0.02937	0.00110	0.282144	0.000011	0.000631	0.000019	1.067	0.282131	0.000022	0.8	0.8	1.53	1.81
MK-2010-A-144[d]	1.46718	0.00004	0.03308	0.00035	0.281877	0.000018	0.000793	0.000035	1.458	0.281855	0.000036	-0.1	1.3	1.90	2.16
MK-2010-A-145	1.46733	0.00004	0.04872	0.00120	0.282189	0.000015	0.000968	0.000013	1.050	0.282170	0.000030	1.8	1.1	1.48	1.73
MK-2010-A-146	1.46731	0.00004	0.05636	0.00019	0.281823	0.000024	0.001280	0.000050	1.588	0.281784	0.000048	0.4	1.7	2.00	2.24
MK-2010-A-147	1.46729	0.00003	0.04665	0.00066	0.282239	0.000013	0.000950	0.000014	0.935	0.282222	0.000026	1.0	0.9	1.41	1.69
MK-2010-A-148	1.46735	0.00004	0.03065	0.00034	0.282266	0.000018	0.000632	0.000026	1.013	0.282254	0.000036	3.9	1.3	1.36	1.57
MK-2010-A-149	1.46725	0.00005	0.04574	0.00070	0.282205	0.000019	0.000815	0.000006	1.029	0.282189	0.000038	2.0	1.3	1.45	1.71
MK-2010-A-150a	1.46730	0.00004	0.09947	0.00140	0.281536	0.000017	0.002063	0.000073	1.803	0.281465	0.000034	-6.0	1.2	2.44	2.79
MK-2010-A-150b	1.46721	0.00012	0.06769	0.00110	0.281577	0.000047	0.002114	0.000057	1.800	0.281505	0.000094	-4.7	3.3	2.39	2.70
MK-2010-A-151	1.46725	0.00003	0.04737	0.00012	0.281974	0.000018	0.000946	0.000012	1.487	0.281947	0.000036	3.8	1.3	1.78	1.95
MK-2010-A-152	1.46723	0.00003	0.09580	0.00160	0.282108	0.000012	0.001841	0.000058	1.269	0.282064	0.000024	3.0	0.9	1.63	1.83
MK-2010-A-153	1.46726	0.00003	0.03393	0.00060	0.282288	0.000015	0.000802	0.000050	0.963	0.282273	0.000030	3.5	1.1	1.34	1.56
MK-2010-A-154	1.46727	0.00003	0.09416	0.00150	0.282139	0.000014	0.001632	0.000012	1.492	0.282093	0.000028	9.1	1.0	1.58	1.63
MK-2010-A-157	1.46719	0.00003	0.03562	0.00250	0.282096	0.000012	0.000680	0.000049	1.056	0.282082	0.000024	-1.2	0.9	1.60	1.92
MK-2010-A-158	1.46729	0.00004	0.03872	0.00028	0.281853	0.000015	0.000794	0.000011	1.294	0.281834	0.000030	-4.6	1.1	1.93	2.31

Notes: ∗) Reported ages are the $^{206}Pb/^{238}U$ ages if younger than or equal to 0.6 Ga, otherwise the $^{206}Pb/^{207}Pb$ ages are used. †) Initial $^{176}Hf/^{177}Hf$ value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a $^{176}Lu/^{177}Hf$ ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.

Table 14: Lu-Hf data for MK-2010-7

	Measured ratios														
Name	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ	Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-7-1	1.46731	0.00003	0.05011	0.00120	0.282552	0.000010	0.001039	0.000007	0.351	0.282545	0.000020	-0.7	0.7	0.98	1.35
MK-2010-7-4	1.46728	0.00004	0.03921	0.00057	0.282778	0.000013	0.000799	0.000012	0.364	0.282773	0.000026	7.7	0.9	0.66	0.84
MK-2010-7-3	1.46721	0.00005	0.04630	0.00240	0.282468	0.000029	0.001291	0.000110	0.338	0.282460	0.000058	-4.0	2.1	1.11	1.54
MK-2010-7-5	1.46728	0.00010	0.03154	0.00023	0.282545	0.000018	0.000698	0.000016	0.626	0.282537	0.000036	5.2	1.3	0.98	1.19
MK-2010-7-7	1.46732	0.00003	0.01699	0.00008	0.281551	0.000014	0.000346	0.000001	0.590	0.281547	0.000028	-30.7	1.0	2.32	3.35
MK-2010-7-8	1.46734	0.00004	0.06635	0.00090	0.282533	0.000011	0.001328	0.000017	0.348	0.282524	0.000022	-1.5	0.8	1.02	1.39
MK-2010-7-9	1.46728	0.00004	0.03786	0.00035	0.282472	0.000016	0.000733	0.000012	0.313	0.282468	0.000032	-4.3	1.1	1.08	1.54
MK-2010-7-10	1.46722	0.00004	0.06134	0.00150	0.281982	0.000013	0.002053	0.000110	1.494	0.281924	0.000026	3.2	0.9	1.82	1.99
MK-2010-7-11	1.46724	0.00003	0.04044	0.00079	0.282505	0.000016	0.000851	0.000046	0.351	0.282499	0.000032	-2.3	1.1	1.04	1.45
MK-2010-7-13	1.46735	0.00005	0.04394	0.00058	0.282090	0.000012	0.000875	0.000012	0.640	0.282079	0.000024	-10.7	0.8	1.61	2.18
MK-2010-7-14	1.46724	0.00003	0.03324	0.00100	0.282450	0.000012	0.000643	0.000014	0.354	0.282446	0.000024	-4.1	0.8	1.11	1.56
MK-2010-7-15	1.46729	0.00003	0.03298	0.00070	0.282004	0.000013	0.000636	0.000009	1.535	0.281985	0.000026	6.3	0.9	1.72	1.83
MK-2010-7-16	1.46728	0.00006	0.02731	0.00087	0.282572	0.000019	0.000574	0.000023	0.316	0.282569	0.000038	-0.6	1.3	0.94	1.32

Table 14 (continued)

Name	Measured ratios $^{178}Hf/^{177}Hf$	1σ	$^{177}Yb/^{177}Hf$	1σ	$^{176}Hf/^{177}Hf$	1σ	$^{176}Lu/^{177}Hf$	1σ	Age (Ga)*	$^{176}Hf/^{177}Hf$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-7-17	1.46726	0.00003	0.06679	0.00300	0.281922	0.000020	0.001343	0.000079	1.493	0.281884	0.000040	1.7	1.4	1.87	2.08
MK-2010-7-20	1.46726	0.00003	0.02919	0.00037	0.282295	0.000013	0.000577	0.000011	0.527	0.282289	0.000026	-5.8	0.9	1.32	1.80
MK-2010-7-21	1.46728	0.00003	0.00778	0.00056	0.282146	0.000013	0.000158	0.000015	0.347	0.282145	0.000026	-14.9	0.9	1.51	2.22
MK-2010-7-22	1.46726	0.00003	0.03775	0.00190	0.281901	0.000013	0.000901	0.000051	1.446	0.281876	0.000026	0.4	0.9	1.87	2.12
MK-2010-7-23	1.46722	0.00003	0.03855	0.00100	0.281905	0.000018	0.000982	0.000085	1.424	0.281879	0.000036	0.0	1.3	1.87	2.13
MK-2010-7-24	1.46727	0.00004	0.02278	0.00040	0.282364	0.000017	0.000583	0.000030	0.473	0.282359	0.000034	-4.5	1.2	1.23	1.68
MK-2010-7-25	1.46727	0.00005	0.08798	0.00410	0.282510	0.000021	0.002436	0.000210	0.328	0.282495	0.000042	-3.0	1.5	1.08	1.47
MK-2010-7-26	1.46732	0.00003	0.02122	0.00120	0.281775	0.000014	0.000449	0.000022	1.546	0.281762	0.000028	-1.4	1.0	2.02	2.31
MK-2010-7-27	1.46720	0.00002	0.02678	0.00210	0.282423	0.000012	0.000783	0.000100	0.589	0.282414	0.000024	0.0	0.8	1.15	1.49
MK-2010-7-28	1.46730	0.00003	0.07222	0.00200	0.282416	0.000015	0.001572	0.000120	0.336	0.282406	0.000030	-5.9	1.1	1.19	1.66
MK-2010-7-29	1.46724	0.00003	0.06427	0.00095	0.282428	0.000017	0.001330	0.000059	0.721	0.282410	0.000034	2.8	1.2	1.16	1.41
MK-2010-7-30	1.46723	0.00003	0.05057	0.00130	0.281928	0.000014	0.001081	0.000022	1.448	0.281898	0.000028	1.2	1.0	1.85	2.08
MK-2010-7-31	1.46728	0.00003	0.03987	0.00220	0.282426	0.000012	0.001017	0.000095	0.354	0.282419	0.000024	-5.1	0.8	1.16	1.62
MK-2010-7-32	1.46725	0.00002	0.02745	0.00013	0.282225	0.000013	0.000551	0.000001	1.063	0.282214	0.000026	3.6	0.9	1.42	1.63
MK-2010-7-33	1.46728	0.00003	0.06357	0.00097	0.282543	0.000009	0.001360	0.000026	0.353	0.282534	0.000018	-1.0	0.6	1.00	1.37
MK-2010-7-35	1.46727	0.00006	0.03779	0.00100	0.282555	0.000012	0.000816	0.000016	0.390	0.282549	0.000024	0.3	0.8	0.97	1.31
MK-2010-7-37	1.46726	0.00004	0.03169	0.00120	0.281847	0.000016	0.000726	0.000031	0.915	0.281834	0.000032	-13.2	1.1	1.94	2.54
MK-2010-7-38	1.46720	0.00004	0.03885	0.00160	0.282140	0.000018	0.001181	0.000084	1.057	0.282116	0.000036	0.0	1.3	1.56	1.85
MK-2010-7-40	1.46731	0.00006	0.05417	0.00360	0.282463	0.000022	0.001559	0.000160	0.586	0.282446	0.000044	1.1	1.6	1.12	1.42
MK-2010-7-41	1.46737	0.00003	0.04224	0.00073	0.282481	0.000013	0.001090	0.000049	0.367	0.282474	0.000026	-2.8	0.9	1.08	1.49
MK-2010-7-42	1.46725	0.00004	0.02910	0.00041	0.282697	0.000016	0.000721	0.000026	0.347	0.282692	0.000032	4.4	1.1	0.77	1.03
MK-2010-7-43	1.46724	0.00003	0.02201	0.00026	0.282503	0.000013	0.000444	0.000005	0.335	0.282500	0.000026	-2.6	0.9	1.03	1.46
MK-2010-7-44	1.46727	0.00005	0.08647	0.00180	0.282424	0.000037	0.002377	0.000150	0.502	0.282402	0.000074	-2.4	2.6	1.20	1.57
MK-2010-7-45	1.46728	0.00006	0.13483	0.00280	0.282423	0.000029	0.003147	0.000220	0.366	0.282401	0.000058	-5.4	2.1	1.23	1.65
MK-2010-7-46	1.46717	0.00005	0.06213	0.00350	0.281446	0.000024	0.001619	0.000160	2.091	0.281382	0.000048	-2.3	1.7	2.54	2.79
MK-2010-7-47	1.46721	0.00003	0.03079	0.00053	0.282158	0.000015	0.000649	0.000007	1.152	0.282144	0.000030	3.2	1.1	1.51	1.73
MK-2010-7-49	1.46719	0.00003	0.02444	0.00044	0.281778	0.000014	0.000513	0.000008	1.505	0.281763	0.000028	-2.3	1.0	2.02	2.33
MK-2010-7-53	1.46720	0.00005	0.04570	0.00092	0.281924	0.000019	0.001161	0.000084	1.475	0.281892	0.000038	1.6	1.3	1.85	2.07
MK-2010-7-55	1.46733	0.00002	0.06457	0.00081	0.282411	0.000011	0.001338	0.000022	0.546	0.282397	0.000022	-1.5	0.8	1.19	1.55
MK-2010-7-56[d]	1.46714	0.00005	0.02760	0.00110	0.282182	0.000023	0.000958	0.000060	0.979	0.282164	0.000046	0.0	1.6	1.49	1.79
MK-2010-7-57	1.46730	0.00003	0.04491	0.00290	0.281278	0.000013	0.000916	0.000052	2.084	0.281242	0.000026	-7.5	0.9	2.72	3.09
MK-2010-7-59	1.46729	0.00003	0.01929	0.00014	0.282480	0.000013	0.000409	0.000002	0.355	0.282477	0.000026	-3.0	0.9	1.06	1.49
MK-2010-7-60	1.46721	0.00003	0.03226	0.00077	0.282382	0.000014	0.000755	0.000051	0.352	0.282377	0.000028	-6.6	1.0	1.21	1.71
MK-2010-7-61	1.46722	0.00003	0.03935	0.00069	0.282547	0.000013	0.000789	0.000016	0.332	0.282542	0.000026	-1.2	0.9	0.98	1.37
MK-2010-7-62	1.46719	0.00004	0.03139	0.00290	0.282512	0.000016	0.000893	0.000110	0.349	0.282506	0.000032	-2.1	1.1	1.03	1.43
MK-2010-7-63	1.46725	0.00002	0.02070	0.00038	0.282250	0.000011	0.000473	0.000026	0.938	0.282242	0.000022	1.8	0.8	1.38	1.65
MK-2010-7-64	1.46724	0.00004	0.02172	0.00060	0.282170	0.000013	0.000558	0.000041	1.121	0.282158	0.000026	3.0	0.9	1.49	1.72
MK-2010-7-65	1.46721	0.00003	0.06212	0.00038	0.282462	0.000010	0.001455	0.000051	0.358	0.282452	0.000019	-3.8	0.7	1.12	1.55
MK-2010-7-66[d]	1.46729	0.00004	0.04499	0.00068	0.282125	0.000012	0.000886	0.000014	1.101	0.282107	0.000024	0.7	0.9	1.57	1.84
MK-2010-7-67	1.46722	0.00013	0.03609	0.00046	0.282522	0.000059	0.000851	0.000014	0.352	0.282516	0.000118	-1.7	4.2	1.02	1.41
MK-2010-7-68	1.46726	0.00019	0.07980	0.00034	0.281779	0.000058	0.001685	0.000034	1.678	0.281725	0.000116	0.3	4.1	2.08	2.31
MK-2010-7-69	1.46717	0.00003	0.02354	0.00081	0.282519	0.000010	0.000483	0.000019	0.597	0.282514	0.000020	3.7	0.7	1.01	1.26
MK-2010-7-70	1.46714	0.00003	0.02264	0.00014	0.281974	0.000011	0.000509	0.000007	1.101	0.281963	0.000022	-4.4	0.8	1.76	2.15

Table 14 (continued)

Name	Measured ratios $^{178}Hf/^{177}Hf$	1σ	$^{177}Yb/^{177}Hf$	1σ	$^{176}Hf/^{177}Hf$	1σ	$^{176}Lu/^{177}Hf$	1σ	Age (Ga)*	$^{176}Hf/^{177}Hf(t)^{\dagger}$	2σ	$\varepsilon_{Hf}(t)^{\ddagger}$	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
MK-2010-7-71	1.46722	0.00003	0.07734	0.00054	0.282183	0.000012	0.001511	0.000009	1.143	0.282150	0.000024	3.2	0.9	1.51	1.72
MK-2010-7-72	1.46722	0.00003	0.07641	0.00160	0.282534	0.000014	0.001638	0.000028	0.352	0.282523	0.000028	-1.4	1.0	1.02	1.39
MK-2010-7-73	1.46730	0.00003	0.03477	0.00390	0.282051	0.000014	0.000707	0.000070	1.299	0.282034	0.000028	2.6	1.0	1.66	1.88
MK-2010-7-75	1.46728	0.00002	0.02394	0.00033	0.282059	0.000013	0.000512	0.000012	1.136	0.282048	0.000026	-0.6	0.9	1.64	1.95
MK-2010-7-78	1.46730	0.00006	0.03724	0.00210	0.281626	0.000037	0.000847	0.000061	1.792	0.281597	0.000074	-1.6	2.6	2.24	2.51
MK-2010-A-159	1.46731	0.00003	0.03861	0.00076	0.281824	0.000016	0.000686	0.000014	1.480	0.281805	0.000032	-1.4	1.1	1.97	2.26
MK-2010-A-160	1.46728	0.00005	0.12533	0.00200	0.282435	0.000019	0.002142	0.000025	0.493	0.282415	0.000038	-2.1	1.3	1.18	1.54
MK-2010-A-162	1.46717	0.00003	0.03279	0.00071	0.282098	0.000015	0.000571	0.000007	1.065	0.282087	0.000030	-0.8	1.1	1.59	1.91
MK-2010-A-163	1.46732	0.00004	0.04406	0.00210	0.282389	0.000015	0.000744	0.000033	0.435	0.282383	0.000030	-4.5	1.1	1.20	1.65
MK-2010-A-164	1.46726	0.00003	0.10084	0.00400	0.282216	0.000015	0.001761	0.000048	1.000	0.282183	0.000030	1.1	1.1	1.47	1.74
MK-2010-A-165	1.46732	0.00002	0.03201	0.00035	0.282146	0.000011	0.000560	0.000001	1.136	0.282134	0.000022	2.5	0.8	1.52	1.76
MK-2010-A-166	1.46724	0.00004	0.03515	0.00044	0.282750	0.000014	0.000709	0.000014	0.530	0.282743	0.000028	10.3	1.0	0.70	0.80
MK-2010-A-167	1.46728	0.00004	0.14074	0.00670	0.282411	0.000016	0.002363	0.000078	0.476	0.282390	0.000032	-3.4	1.1	1.22	1.61
MK-2010-A-168	1.46720	0.00004	0.06770	0.00180	0.281899	0.000016	0.001645	0.000061	1.592	0.281849	0.000032	2.8	1.1	1.91	2.09
MK-2010-A-169	1.46731	0.00005	0.07804	0.00100	0.282028	0.000017	0.001432	0.000064	1.334	0.281992	0.000034	1.9	1.2	1.72	1.94
MK-2010-A-170	1.46729	0.00007	0.02985	0.00049	0.282324	0.000021	0.000713	0.000023	0.950	0.282311	0.000042	4.5	1.5	1.29	1.49
MK-2010-A-171	1.46722	0.00005	0.04208	0.00063	0.282217	0.000016	0.000714	0.000002	1.079	0.282202	0.000032	3.6	1.1	1.43	1.65
MK-2010-A-172	1.46720	0.00009	0.07621	0.00110	0.281994	0.000030	0.002389	0.000061	1.173	0.281941	0.000060	-3.5	2.1	1.82	2.15
MK-2010-A-173	1.46717	0.00004	0.07323	0.00240	0.281806	0.000014	0.001351	0.000049	1.571	0.281766	0.000028	-0.7	1.0	2.03	2.29
MK-2010-A-174	1.46723	0.00004	0.05710	0.00210	0.282629	0.000016	0.001186	0.000050	0.353	0.282621	0.000032	2.1	1.1	0.88	1.18
MK-2010-A-176	1.46721	0.00003	0.05552	0.00086	0.282457	0.000013	0.001039	0.000007	0.353	0.282450	0.000026	-4.0	0.9	1.11	1.55
MK-2010-A-177	1.46723	0.00005	0.12439	0.00210	0.282462	0.000014	0.002240	0.000054	0.467	0.282442	0.000028	-1.7	1.0	1.14	1.50
MK-2010-A-178	1.46725	0.00003	0.04982	0.00070	0.282472	0.000014	0.000937	0.000007	0.331	0.282466	0.000028	-3.9	1.0	1.09	1.53
MK-2010-A-179[d]	1.46725	0.00003	0.03335	0.00037	0.282491	0.000011	0.000649	0.000002	0.353	0.282487	0.000022	-2.7	0.8	1.06	1.47
MK-2010-A-180	1.46723	0.00002	0.03227	0.00060	0.282186	0.000012	0.000574	0.000005	0.898	0.282176	0.000024	-1.4	0.9	1.47	1.81
MK-2010-A-181	1.46722	0.00003	0.06690	0.00140	0.281827	0.000011	0.001271	0.000025	1.625	0.281788	0.000022	1.3	0.8	1.99	2.20
MK-2010-A-182	1.46721	0.00002	0.03182	0.00170	0.281847	0.000015	0.000651	0.000020	1.607	0.281827	0.000030	2.3	1.1	1.93	2.13
MK-2010-A-183	1.46727	0.00003	0.02273	0.00022	0.282689	0.000017	0.000444	0.000005	0.374	0.282686	0.000034	4.8	1.2	0.78	1.02
MK-2010-A-184	1.46724	0.00004	0.03058	0.00110	0.282144	0.000015	0.000587	0.000014	1.327	0.282129	0.000030	6.6	1.1	1.53	1.65
MK-2010-A-185	1.46723	0.00004	0.01598	0.00047	0.281303	0.000015	0.000303	0.000011	2.011	0.281291	0.000030	-7.4	1.1	2.64	3.03
MK-2010-A-186[d]	1.46723	0.00003	0.05510	0.00069	0.282589	0.000014	0.001188	0.000007	0.343	0.282581	0.000028	0.4	1.0	0.93	1.27
MK-2010-A-187	1.46725	0.00004	0.07686	0.00230	0.281778	0.000021	0.001456	0.000030	1.595	0.281734	0.000042	-1.3	1.5	2.07	2.34
MK-2010-A-188	1.46729	0.00004	0.06560	0.00610	0.282537	0.000010	0.001211	0.000097	0.347	0.282529	0.000020	-1.3	0.7	1.01	1.38
MK-2010-A-189	1.46723	0.00004	0.01809	0.00027	0.282256	0.000015	0.000329	0.000002	1.076	0.282249	0.000030	5.2	1.1	1.37	1.54
MK-2010-A-190	1.46728	0.00003	0.07484	0.00170	0.282116	0.000017	0.001316	0.000019	1.324	0.282083	0.000034	4.9	1.2	1.60	1.75
MK-2010-A-191	1.46728	0.00003	0.03108	0.00028	0.282134	0.000014	0.000610	0.000002	1.218	0.282120	0.000028	3.8	1.0	1.54	1.74
MK-2010-A-192[d]	1.46721	0.00003	0.08914	0.00210	0.282503	0.000013	0.001689	0.000039	0.305	0.282493	0.000026	-3.5	0.9	1.07	1.49
MK-2010-A-193	1.46727	0.00003	0.11046	0.00140	0.282656	0.000013	0.002213	0.000028	0.514	0.282635	0.000026	6.1	0.9	0.86	1.05
MK-2010-A-194[d]	1.46724	0.00005	0.03855	0.00044	0.282445	0.000019	0.000728	0.000005	0.361	0.282440	0.000038	-4.2	1.3	1.12	1.57
MK-2010-A-195	1.46721	0.00005	0.02613	0.00008	0.281966	0.000018	0.000496	0.000004	1.476	0.281952	0.000036	3.8	1.3	1.77	1.94
MK-2010-A-196	1.46724	0.00003	0.02073	0.00011	0.282119	0.000015	0.000405	0.000003	1.162	0.282110	0.000030	2.2	1.1	1.55	1.79
MK-2010-A-197	1.46720	0.00003	0.03405	0.00042	0.281234	0.000014	0.000660	0.000003	2.531	0.281202	0.000028	1.5	1.0	2.76	2.90
MK-2010-A-198	1.46740	0.00004	0.04918	0.00130	0.282160	0.000017	0.001053	0.000023	1.294	0.282134	0.000034	6.1	1.2	1.52	1.66

Table 14 (continued)

Name	Measured ratios								Age (Ga)*	$\frac{^{176}Hf}{^{177}Hf}$(t)†	2σ	ε_{Hf}(t)‡	2σ	T_{DM} (Ga)§	T^{C}_{DM} (Ga)¶
	$\frac{^{178}Hf}{^{177}Hf}$	1σ	$\frac{^{177}Yb}{^{177}Hf}$	1σ	$\frac{^{176}Hf}{^{177}Hf}$	1σ	$\frac{^{176}Lu}{^{177}Hf}$	1σ							
MK-2010-A-199	1.46730	0.00004	0.03482	0.00033	0.282122	0.000017	0.000717	0.000015	0.604	0.282114	0.000034	-10.3	1.2	1.56	2.13
MK-2010-A-200	1.46727	0.00003	0.04534	0.00092	0.281819	0.000011	0.000982	0.000020	1.641	0.281788	0.000022	1.7	0.8	1.99	2.19
MK-2010-A-201	1.46719	0.00004	0.07772	0.00200	0.281938	0.000017	0.001570	0.000075	1.533	0.281892	0.000034	2.9	1.2	1.86	2.04

Notes: $*$) Reported ages are the $^{206}Pb/^{238}U$ ages if younger than or equal to 0.6 Ga, otherwise the $^{206}Pb/^{207}Pb$ ages are used. †) Initial $^{176}Hf/^{177}Hf$ value, calculated at the reported age. ‡) ε_{Hf} calculated at the reported age. §) Depleted mantle age, calculated using the measured values and the model of Griffin et al. (2000) modified to the CHUR values from Bouvier et al. (2008) and ^{176}Lu decay constant from Söderlund et al. (2004). ¶) Modelled crustal age, assuming the parental magma had a $^{176}Lu/^{177}Hf$ ratio of 0.015 (similar to average continental crust; Griffin et al. 2002, 2004). d) Discordant U-Pb age; not used in plots.